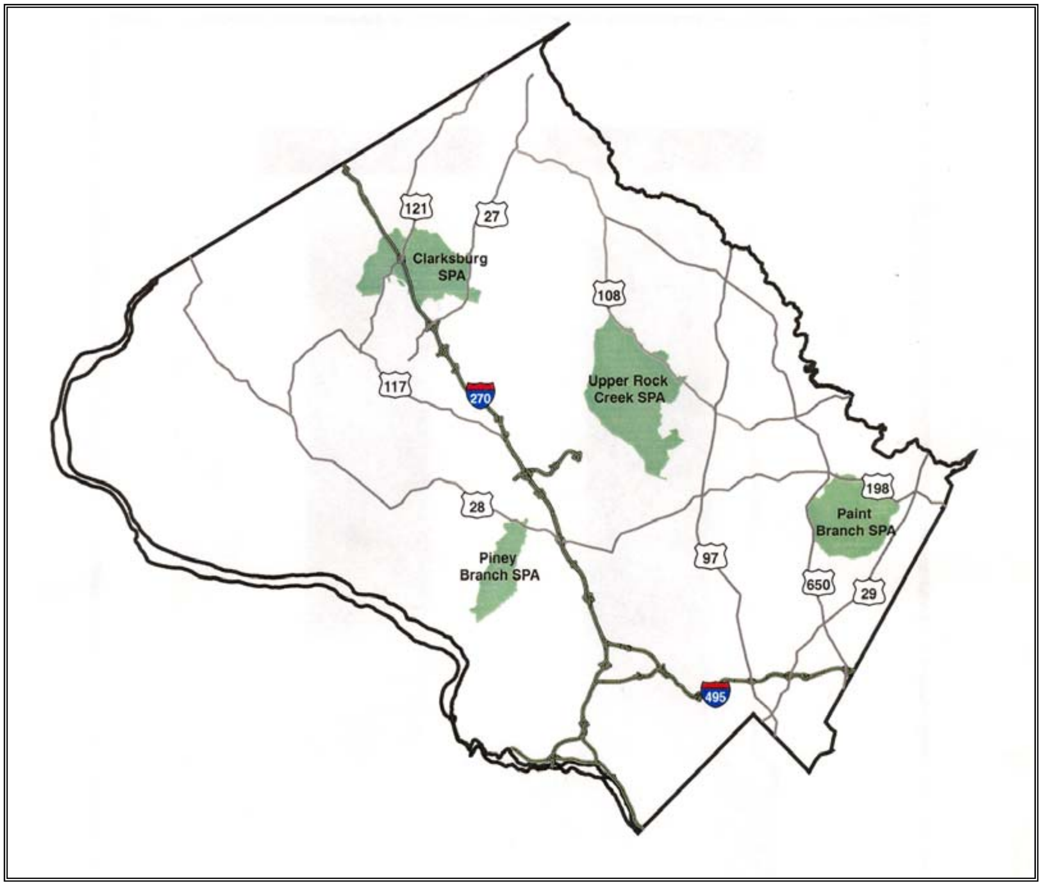
Special Protection Area Program Annual Report 2006



Prepared by the Montgomery County Department of Environmental Protection in Cooperation With the Department of Permitting Services and the Maryland-National Capital Park and Planning Commission

Note to Reader: The Clarksburg Master Plan requires development in four different stages, each with its own set of triggers. There are four triggers that must occur before the County Council will consider water and sewer category changes for development in the Stage IV area (Ten Mile Creek watershed). One of the remaining triggers for Stage IV was met during the development of this Annual Report for 2006; the issuing of at least 2,000 building permits for housing units in the Newcut Road and Town Center sub-areas of Clarksburg. According to the Clarksburg Master Plan (June 1994), the first "*Annual Report on the Water Quality Review Process*" following the release of 2,000 building permits in the Newcut Road and Town Center sub-areas ..."*will have evaluated the water quality best management practices (BMPs) and other mitigation techniques associated with Town Center/Newcut Road development and other similar developments in similar watersheds where BMPs have been monitored".* That report is the Special Protection Area Annual Report for 2007 and is anticipated to be completed by April 30, 2008.

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EXECUTIVE SUMMARY

I. INTRODUCTION

The Special Protection Area (SPA) Program was established in 1994 by Montgomery County Code Chapter 19, Article V (Water Quality Review-Special Protection Areas, Section 19-67) and the program was implemented through Executive Regulation 29-95, *Water Quality Review for Development in Designated Special Protection Areas*. This SPA Annual Report summarizes available monitoring results of streams and best management practices (BMPs) collected within SPAs during the 2006 calendar year. Sediment and erosion control BMPs are designed to deal with large amounts of sediment laden run-off generated during construction. Stormwater management BMPs are installed after construction and are designed to attenuate storm flows (quantity control) and control pollutant loads (quality control). SPA reports are submitted annually to the County Executive and County Council with a copy to the Montgomery County Planning Board.

II. BMP MONITORING PROGRAM

A. General

Development activities in three of the SPAs (Piney Branch, Upper Paint Branch and the Clarksburg Master Plan area) have reached a point where most of the developable property has been developed. However, the development process for many of these properties has not progressed to the point where sediment and erosion control devices (S&E) used during construction can be converted to stormwater management best management practices (SWM BMPs). Small areas of undeveloped lots, road projects or other construction activities typically delay the conversion of sediment control traps and basins to stormwater management. Post-construction SWM BMP monitoring does not begin until a BMP has been converted from S&E to SWM BMP and as-built inspections have been approved. The delay of conversion may impact the receiving streams because the sediment and erosion control devices are not designed to attenuate storm flows and control pollutant loads (which may also include sediment). The Department of Environmental Protection (DEP) and the Department of Permitting Services (DPS) are exploring ways to provide localized S&E controls for the small remaining undeveloped areas so that the downstream S&E structures can be converted to stormwater treatment during this late phase of construction.

B. Sediment and Erosion Control Effectiveness

1. Sediment

Sediment control structure monitoring in 2006 indicates good performance and supports results obtained from years of grab samples collected in the SPAs. Flow weighted sampling of two sediment control structures highlights the importance of structure location and integrating the structures into the site design. One structure had little to no surface outflow for four storms because flows infiltrated into underlying soils essentially producing 100 percent effectiveness in preventing sediments from reaching surface waters. In another structure, groundwater exfiltration caused extended flows from another sediment control structure that reduced the structure's overall effectiveness. One reason for the failure of this device was the fact that it was located after other features of the site, including the number and location of lots, were considered.

2. Thermal Impacts

Sediment control traps are designed to retain a permanent pool of water. During larger rain events, this warm pool of water is flushed out to the receiving stream. The result is a brief sharp increase of water temperature in the stream. These brief temperature spikes have not impacted the downstream biological communities.

C. Stormwater BMP Effectiveness

Once development is completed, sediment and erosion control structures are converted to stormwater control facilities when their drainage areas have been stabilized. Conversion rates have been slow. As mentioned previously, the delays have been for a variety of reasons including the slowdown in the housing market and the need to provide S&E control for future road projects in a portion of the drainage area contributing to sediment control and stormwater management devices. As of this report, the delay in conversion has prevented the County from obtaining adequate post construction SWM BMP monitoring information to evaluate the effectiveness of the BMPs in the Clarksburg Town Center and portions of the Newcut Road Neighborhoods.

1. Thermal Impacts

Post-development temperature monitoring results show no difference in upstream and downstream water temperatures, indicating that the goal of minimizing temperature impact has been achieved on the eight projects evaluated thus far.

2. Groundwater

Six projects had submitted post-development groundwater monitoring data. Five of the six projects showed no groundwater impact. The results of groundwater monitoring of one project (Briarcliff) indicated groundwater level impacts. Groundwater level impacts are indicative of changes to hydrology that can affect the long term health of the stream.

III. STREAM MONITORING PROGRAM

A. General Observations

1. Two droughts in recent years, 1999 and 2002, had a negative effect on the biological health of all streams. In streams that were also influenced by the cumulative impacts associated with SPA development related stressors, stream conditions further declined.

2. The level of decline varies with the intensity and imperviousness levels of new development. Streams in subwatersheds where large areas of grading and filling have occurred as part of the development process are showing greater decline in stream conditions. Streams have not recovered to pre-development conditions in areas of higher imperviousness and more intense development.

B. Stream Monitoring Results

1. Piney Branch SPA

Construction of large-scale development projects has been ongoing in the Piney Branch watershed since 1995; for the most part, construction of large-scale development projects is now completed. SWM BMPs are still in the process of being converted from sediment and erosion control devices, but all of the water quality BMPs should be completed and approved by early 2008. Stream monitoring results from 2006 found *poor* Index of Biological Integrity (IBI) scores in the upper portions of the watershed where the densest development activity has been located. IBI scores in the lower regions were *fair*. The western tributary control site indicated *good* conditions again. This is similar to results obtained for ten of the last twelve years.

2. Paint Branch SPA

The last SPA Annual Report found improved biological conditions in Paint Branch. Biological monitoring results from 2006 indicate a watershed-wide decrease in stream conditions in Paint Branch SPA streams. A similar decrease was not seen in the other SPAs. No specific cause for this decline has been identified. Brown trout numbers which were up in 2005 were down in 2006. The population is persisting, but at lesser numbers. Three more brown trout young-of-year were found in 2006 than in 2005, but reproduction still seems to be far below rates seen in the 1990's.

3. Clarksburg SPA

Stream conditions in Clarksburg SPA remain high in areas unimpacted by development (Ten Mile Creek watershed). Areas with intensive development activity are significantly lower and continue to decline. Monitoring of benthic macroinvertebrates indicate that areas impacted by development had the lowest water quality conditions on average since large scale construction began in 2003. This development activity is having a cumulative impact on stream conditions.

4. Upper Rock Creek SPA

The year 2006 was the third year of stream monitoring in this newly created SPA. Stream monitoring is only done in small tributaries that receive runoff from large parcels of developable land. Results from 2006 are similar to 2004 and 2005. Biological monitoring indicates that the six monitored tributaries have consistently *good* stream conditions.

IV. RECOMMENDATIONS

A. Historically, sediment and erosion control and stormwater management requirements have not been given the same priority as achieving desired densities in the highly impervious Clarksburg Master Plan SPA developments. This continues to cause problems arriving at cost-effective and practical siting decisions for sediment and erosion control structures and stormwater management facilities. In some cases, these decisions have required locating stormwater management quantity structures near environmentally sensitive stream valley buffers, or in areas with high water tables, because little room was provided in other less environmentally sensitive areas in order to achieve desired lot yields.

B. Solely relying on engineered structures will not be 100 percent successful in maintaining *good* to *excellent* stream conditions. The structures must be fully integrated into environmentally sensitive site designs from the start. Headwater streams cannot support the levels of imperviousness that larger streams may be capable of supporting. This is evident after monitoring the reaction of the Paint Branch headwaters (with a 10 percent imperviousness cap) to those of the Clarksburg headwaters (no imperviousness cap).

C. Monitoring of best management practices is currently done by private consultants paid for and managed by the developer. The monitoring is approved as part of the Water Quality Plan and is done on the specific development site. This regulatory requirement makes it difficult, if not impossible, to revise monitoring plans to move the monitoring to other sites and other BMPs that have a higher priority to be monitored. County Code Chapter 19 should be revised so that future BMP monitoring will be managed by the County and not by SPA project developers. Monitoring costs should be funded through a BMP monitoring fee assessed to project developers. It is anticipated that there would be no net cost increase to developers.

D. There are continuing conflicts between SPA goals for environmentally sensitive developments and Road Code and other requirements that sometimes foster increased impervious areas and excessive use of cut and fill to minimize road grade changes. It is anticipated that the new revisions to the Road Code will consider these conflicts.

E. DEP and DPS will explore ways to provide localized S&E controls so downstream S&E structures can be converted to stormwater treatment during the late phase of construction.

SPECIAL PROTECTION AREA
2006 ANNUAL REPORT

I. PURPOSE AND BACKGROUND

The Special Protection Area Program was established in 1994 by Montgomery County Code Chapter 19, Article V (Water Quality Review-Special Protection Areas, Section 19-67) and the program was implemented through Executive Regulation 29-95, *Water Quality Review for Development in Designated Special Protection Areas*. The law and regulations require an Annual Report be prepared that summarizes available monitoring results of stream and best management practices collected within Special Protection Areas. This report is submitted annually to the County Executive and County Council with a copy to the Montgomery County Planning Board.

The County Council has designated four areas within Montgomery County as Special Protection Areas (Figure 1). The designated areas are Clarksburg Master Plan SPA, Upper Paint Branch SPA, Piney Branch SPA, and the Upper Rock Creek SPA. Upper Rock Creek was designated as an SPA on February 24, 2004, with the adoption of the Upper Rock Creek Master Plan. All four SPAs have existing water resources or other environmental features directly relating to those water resources that are of high quality or unusually sensitive; and where proposed land uses would threaten the quality or preservation of those resources or features in the absence of special water quality protection measures which are closely coordinated with appropriate land use controls. Appropriate land use controls are those that help ensure that the impacts from master planned development activities are mitigated to the greatest extent practicable. Examples of these controls include reducing imperviousness, minimizing grading, and saving natural features such as forested stream buffers. Special water quality protection measures include sediment control and stormwater management structures that go beyond current minimum standards.

The SPA program requires the Montgomery County Department of Permitting Services (DPS), the Department of Environmental Protection (DEP), and the Maryland-National Capital Park and Planning Commission (MNCPPC) to work closely with project developers from the outset of the regulatory review process to minimize impacts to SPA stream conditions. SPA permitting requirements guide the development of concept plans for site imperviousness, site layout, environmental buffers, forest conservation, sediment control and stormwater management. Applicant requirements to carry out monitoring of sediment/SWM are guided by performance goals developed for each development project. Achievement of the performance goals through the site plan design process and accompanying permitting requirements for sediment, erosion and stormwater

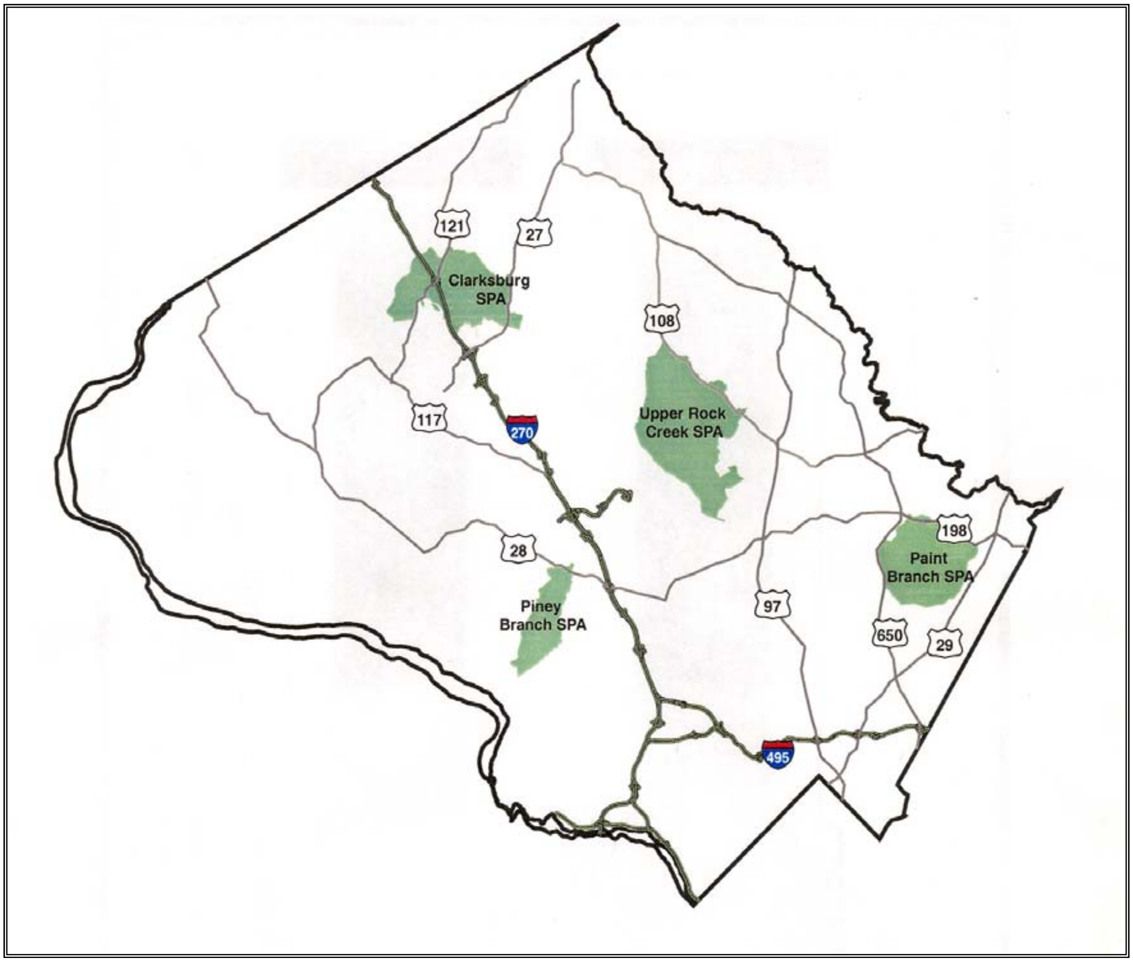

Figure 1. Location of Special Protection Areas in Montgomery County

management controls requires close coordination between the project's design team and environmental, regulatory and planning agencies.

Since the SPA program was established in 1994, DEP has conducted stream monitoring to evaluate water quality and development impacts in the SPAs. By monitoring and assessing the aquatic biological community year round, the County learns about the cumulative impacts affecting the stream as the organisms either survive or die due to changing water quality and habitat.

With the data collected in the past thirteen years, DEP has been able to track water quality conditions in the SPAs. DEP has established that Clarksburg SPA streams had consistently high water quality until the beginning of large scale development. Development impacts there are most significant in headwater areas with extensive development, but impacted area has been spreading over time. Paint Branch streams have also exhibited *good* water quality conditions, but with some variability that is probably due to the large amount of older development in the area. New development in that area has been done at lower densities leaving extensive stream buffers. The impacts to the stream benthic macroinvertebrate community seen in Clarksburg have not been seen in Paint Branch. The lower densities and extensive buffers may have minimized impacts. Physical habitat has also been monitored using temperature loggers, surveyed cross sections and other methods. Overall stream channels in the SPAs have been found to be stable. Only small impacts on stream temperatures have been observed which are not expected to impact stream biota.

DEP has also been requiring sediment and erosion control and stormwater management Best Management Practice (BMP) monitoring as part of the SPA program. Sediment and erosion control BMPs are designed to deal with large amounts of sediment laden run-off generated during construction. Stormwater management BMPs are installed after construction and are designed to attenuate storm flows (quantity control) and control pollutant loads (quality control). Developers are required to monitor selected parameters to evaluate the effectiveness of their BMPs in minimizing development impacts to the receiving stream. This data is intended to be used to evaluate the design and function of SPA BMPs, link BMP performance to changing stream conditions, and guide future planning decisions.

II. SPA REVIEW PROCESS

A. Plan Review Process

The protection of those natural features necessary to sustain important aquatic resources has not always been successful in approved SPA development plans. Protection of these natural resource parameters is guided by performance goals developed for each development project as part of a Water Quality Plan. Successful incorporation of the performance goals into the Water Quality Plan and the site design process requires continuing innovation and close coordination and review between the project's design team and environmental, regulatory and planning agencies.

When protection of these natural features is not considered in the early stages of preparing a development plan, opportunities for sustainability are not fully achieved and resources may not be fully protected. DPS and DEP have encountered problems with site planning decisions that have greatly complicated arriving at cost-effective and practical siting decisions for sediment and erosion control structures and stormwater management facilities. In some cases, for example, these decisions have required locating sediment structures and stormwater facilities in areas with high water tables.

There are also continuing conflicts between SPA goals for environmentally sensitive developments and Road Code and other requirements that, sometimes, unnecessarily foster increased impervious areas and excessive use of cut and fill to minimize road grade changes. These changes from development complicate the protection of natural stream systems.

Closer coordination is needed between the environmental, permitting, and planning agencies and SPA project design teams to ensure that planning and subdivision decisions on lot siting decisions, lot coverage, and Road Code requirements do not preempt locations for practical, cost-effective sediment control and stormwater management facilities. Decisions on lot siting, location and on roads need to be made with a fuller appreciation of implications these decisions have on natural drainage patterns, stream systems, sediment control and stormwater facility options. These decisions must also better understand and accommodate maintenance access requirements, costs and maintainability of stormwater management structures.

B. BMP Monitoring Review Process

County staff will be recommending changes to Chapter 19 and BMP monitoring requirements in SPAs. The County recommends that BMP monitoring responsibility would be managed by the DEP rather than by project developers and funded through a one-time fee paid to the County. This would give the County direct control over the quality assurance/quality control requirements and data submission requirements. The County's other annual stream monitoring activities within SPAs would not change. The County will continue to annually monitor and report upon trends in stream conditions in all SPAs. All other SPA Water Quality Plan Review and reporting aspects of the SPA program would also remain the same.

The County would target future BMP monitoring to focus within the Clarksburg SPA to enable collected data to be combined with supporting data being gathered through an ongoing and extensive interagency monitoring effort in the watershed. This data includes supplemental data from five stream flow monitoring stations and nutrient sampling in surface water and groundwater. BMP monitoring would also be done within the Upper Rock Creek SPA (8 percent impervious cap) and the Upper Paint Branch SPA (10 percent impervious cap). Monitoring of BMPs within these lower impervious limits would provide information on BMP efficiency within lower densities than those approved for Clarksburg. BMP monitoring and the per acre fee would provide information on the effectiveness of sediment and erosion control devices and SWM treatment trains; the ability of infiltration to maintain groundwater recharge to receiving streams; and changes to surface hydrology due to landscape changes in developing SPA watersheds. Once an adequate number of a particular BMP has been identified to be monitored, resources could then be allocated to cover other BMP types. This cannot be done under the current SPA law.

C. BMP Technology Selection

The SPA regulations require BMP monitoring to be done at select stormwater management and sediment and erosion control devices. The information collected, when combined with data from the County's biological stream monitoring program, can then be used to assess and refine the effectiveness of the County's current BMP designs over a range of drainage areas, land use, and impervious levels.

Staff has compiled permitting information on all monitoring being required under the BMP monitoring program. Results offer an opportunity to evaluate the current direction of the program and whether revisions are necessary. The current program evolved as individual SPA properties came in for Water Quality Plan approval as part of the development permitting process. Although every type of BMP allowable in the State design manual is used in the SPAs, DEP's review found that monitoring of the full range of different BMP technology was not being provided to evaluate comparative effectiveness. This is primarily because developers tend to choose those most tried and true technologies.

BMP monitoring to date has almost been entirely focused on the pre-development and during development phases. Very few post-development BMP monitoring projects required in the Water Quality Plans for individual SPA projects have actually been done thus far. The few post-construction BMP monitoring projects to date (mostly in older Piney Branch SPA developments) has consisted of end-of-pipe monitoring to assess the impacts of the BMP discharge to the receiving stream as opposed to inlet and outlet monitoring of specific BMPs. In the Clarksburg SPA, where the acreage undergoing land use change has been the greatest, development has not proceeded to the post-construction monitoring phase as of 2006.

III. BMP MONITORING RESULTS

A. General

This section of the SPA annual report presents information on BMP monitoring results from 2006. Only a few large development projects within SPAs have been fully completed and stabilized with sediment controls removed and replaced by permanent stormwater control structures that are being maintained by the County. This report presents limited amount of data on completed development conditions.

B. BMP Monitoring

The goals of the BMP monitoring program are to assess the effectiveness of SPA sediment and erosion control devices and stormwater management BMPs. One of the anticipated outcomes of the SPA program was to test and validate the effectiveness of new and innovative sediment and stormwater control devices. While structure designs have changed little over time, the County has greatly decreased the size of the drainage area being treated by a structure. Smaller areas are being controlled thus increasing the number of structures. Consultants are contracted by individual project developers who are responsible for monitoring BMPs as specified in the Water Quality Plan for each project. Each consultant follows County methods and procedures. Recognizing practical site conditions, feasibility and cost considerations, BMP monitoring is not required for all SPA development projects. There are many projects where, because of the relatively small property sizes or other reasons, no BMP monitoring is being required.

In past reports, the amount of monitoring information presented on loadings from BMP sediment control and stormwater management structures has been limited. The data presented in this report is for two SWM BMP structures and two sediment and erosion control devices. It is still only a small amount, but it does provide some reliable information on structure effectiveness that can be used to improve future designs. This data is collected throughout a storm in proportion to stormwater flow rates with a goal to accurately represent the entirety of the storm flow. Without information on flow rates it is not possible to evaluate the total amount of pollutants contained in the runoff from a storm. Flow weighted sampling also facilitates comparison with data collected in other monitoring programs, as this is the approach recommended by the American Society of Civil Engineers. More of this loading data should be obtained in the next couple of years as the numbers of larger projects complete construction.

Thirteen projects have finished submitting data on post-construction conditions, one on monitoring of a structure. (Figure 2). Twelve projects collected information on groundwater levels, stream temperatures and embeddedness. One collected data on the effectiveness of the BMP structure. Eight projects are currently collecting post-construction data, four of which are on BMP structure effectiveness. Fourteen projects are collecting data on construction conditions and two projects are collecting data prior to development. Work was begun in 2006 on a database that will contain all the SPA BMP monitoring data. That database should be fully functional by April 2008.

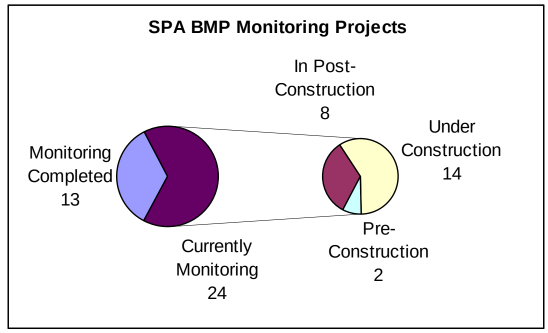

Figure 2 SPA BMP Monitoring Projects

Sediment and Erosion Control Effectiveness (Monitoring During Development)

In past SPA Annual Reports, data has been presented on the effectiveness of sediment control structures based on grab sample data. The grab data have been reasonably consistent and appeared reliable, but without accompanying flow data it was not possible to know whether the samples accurately represented entire storms. DEP has continued to receive grab sample data from SPA sediment control structures. Twenty-two samples were collected from six structures in 2006. A total of 78 grab samples have been collected from 2002 to 2006 from SPA sediment control structures.

As indicated in Figure 3, monitoring results continue to show sediment and erosion control devices receiving dirty water (likely to occur during the early development periods involving cutting, filling and grading) to be generally effective. Results show a general decrease in sediment concentrations leaving properly installed and regularly maintained sediment control basins and traps from that entering the basin or trap with a median value of 77.5 percent (Figure 4). At concentrations below 100 mg/l, the results are more variable. In those instances where the stormwater Total Suspended Solids (TSS) concentration in the forebay of a structure was relatively clean (less than 100mg/l), almost as many samples had higher concentrations leaving the site then those that had lower concentrations leaving the site (Figure 5). The relatively cleaner water (less than 100mg/l) entering the sediment and erosion control devices could be the result of the sampling taking place fairly late in the grading and site preparation process - during the period where most of the cut and filling was completed and final lot and road grades were completed. Soils are compacted during this phase to maintain the surveyed final grades. The higher outfall concentrations could be from the re-suspending of fine clays and silts already in the control structure basin. As projects get closer to completion and less exposed earth is present on a site, there comes a point where there may be more sediment accumulated from prior storms getting washed out of structures than is being trapped. The County is evaluating if sediment and erosion control devices can be changed over to a stormwater facility as soon as the primary grading, cutting and filling is complete.

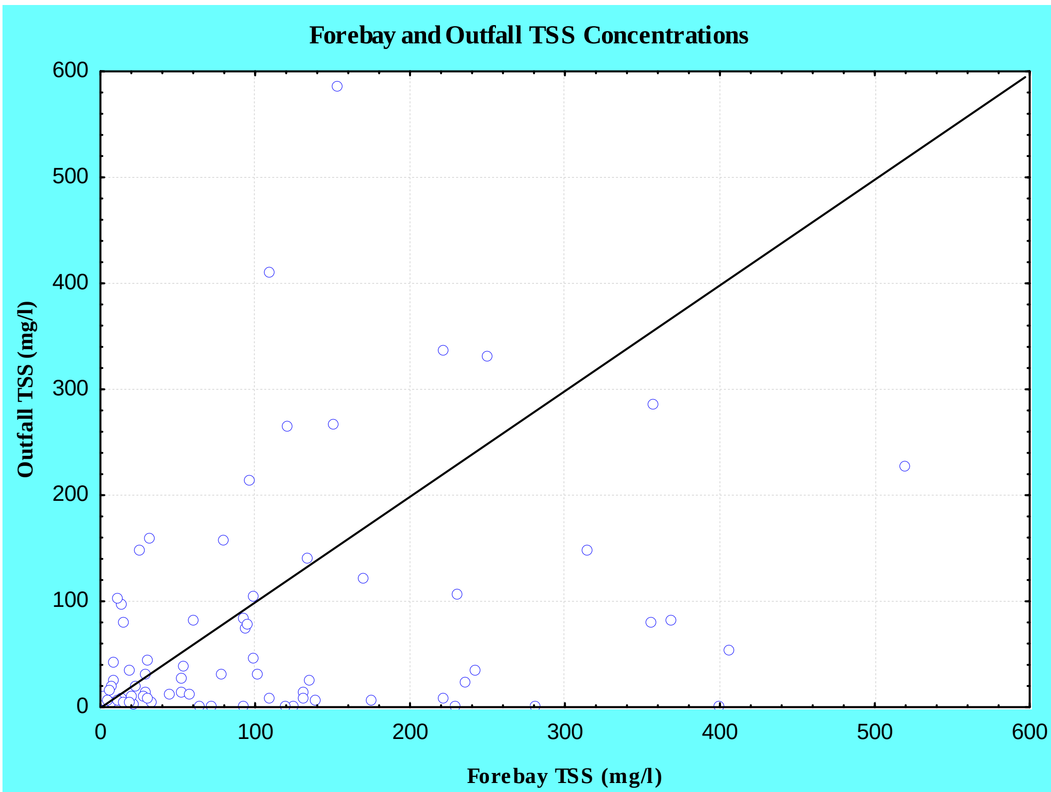

Figure 3. Forebay and Outfall TSS Concentrations

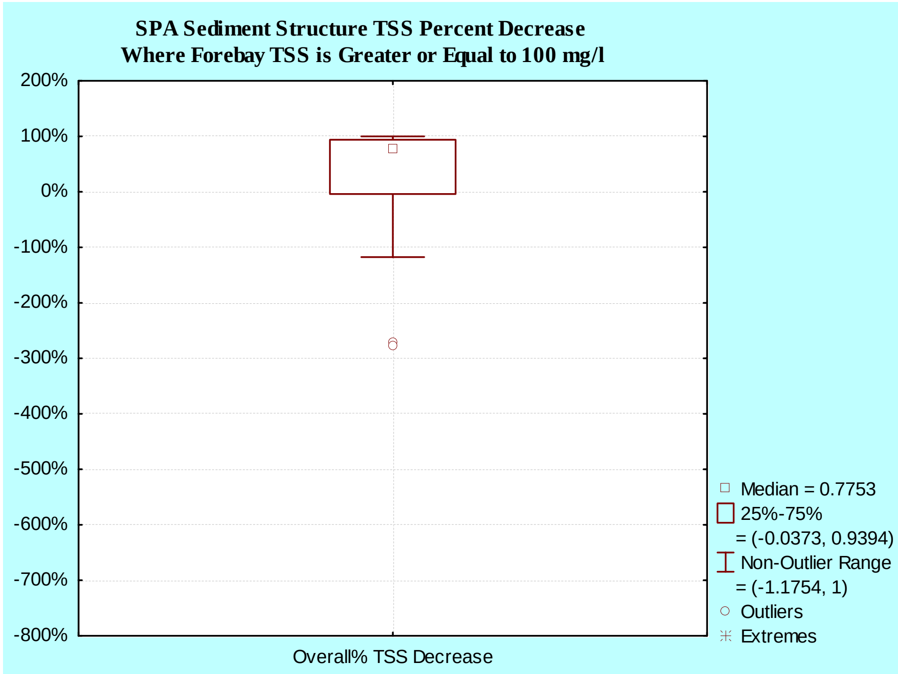

Figure 4. Percent Difference in Forebay and Outlet TSS Concentrations Where Forebay TSS Values are Greater or Equal to 100 mg/l.

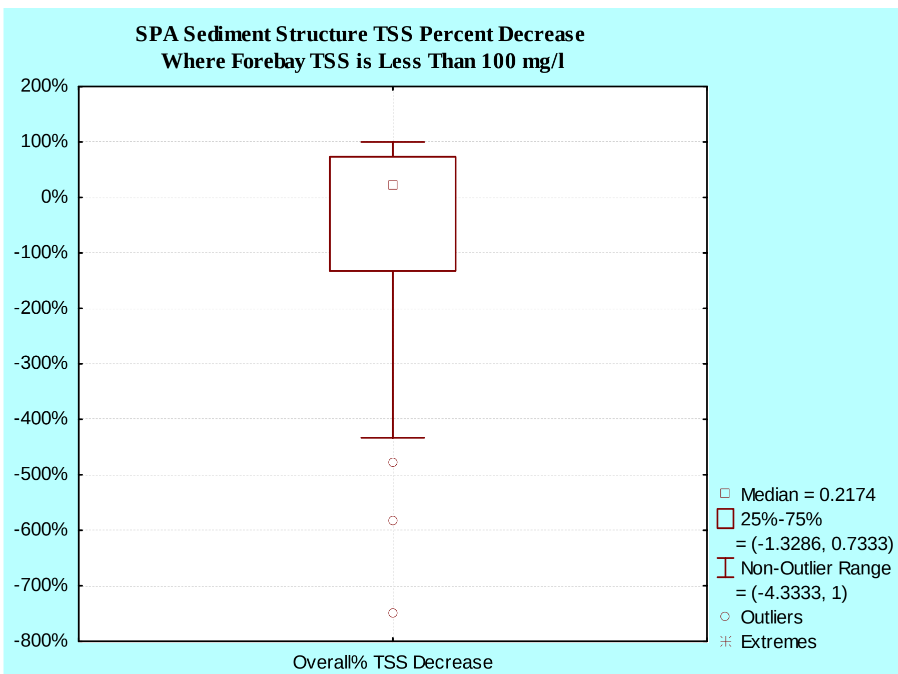

Figure 5. Percent Difference in Forebay and Outlet TSS Concentrations Where Forebay TSS Values are Less Than 100 mg/l.

In 2006 flow weighted samples were obtained from two projects which provide information on sediment loadings and can be compared to the SPA grab sample data already obtained. However, both of these projects had problems related to monitoring; one structure intercepted groundwater and the other had no outflow from sampled storms.

Data has been collected from the Clarksburg Town Center on sediment basin effectiveness for six storms (Table 1). This structure has been difficult to sample because it continues to discharge water for a much extended period after storms are over. Groundwater enters the structure and causes it to continue discharging long after the storm flow volume should have drained out. Because of the difficulty determining when the runoff from a storm has been discharged, staff decided to measure flows leaving the facility for a consistent time span. The automated sampling equipment can hold a set sample volume before it must be emptied and reset for the next round of sampling. In 2006 one round of sampling was performed per storm. One round of sampling has lasted for 34 hours on average after the end of the storm even though flows have continued for up to twenty days after a rain event. These results need to be used cautiously in understanding the effectiveness of the facility and the loadings it is delivering to streams from individual storms because of the difficulty in determining when the storm flow discharge has passed through the structure.

Table 1. Sediment Loadings: Clarksburg Town Center Phase II-B Sediment Basin #3

		TSS Loading (lbs)			TSS Reduction					
Date of Event	Rain (in.)	Inlets	Outfall (One Round)	Outfall (Extended Sampling)	One Round Outfall Sampling	Extended Outfall Sampling	Duration of Outfall Sampling (One Round, hours)	Duration after Rainfall Cessation (hours)	Duration of Extended Outfall Sampling (hours)	Ratio of Inflow Volume to Outflow Volume
4/30/05	0.82	59.2	43.4	103	27%	-74%	55.33	33.55	339.6	10.00
5/19/05	1.04	366	43.2	68.5	88%	81%	46	28.28	88.75	0.81
5/23/05	0.84	146	17.5	34.3	88%	76%	44	12.63	170.5	0.68
5/11/2006*	1.76	342.1	196.7	n.a.	43%	n.a.	60	43.75	n.a.	2.71
6/1/2006*	0.45	1217	37.1	n.a.	97%	n.a.	76.67	45.67	n.a.	1.20
9/1/2006*	1.95	7.4	4.4	n.a.	41%	n.a.	80	42.67	n.a.	1.00
Mean	**1.14**	**356**	**57.1**	**69**	**64%**	**28%**	**60**	**34.43**	**199.6**	**2.73**

(*)In 2006, sampling was limited to one round after cessation of rainfall. In 2006, that period averaged 44 hours. For 2005 and 2006 (combined), the period averaged 34 hours.

In 2006, the data from three storm events indicate the structure was consistently effective in trapping sediment (Figure 6) up to a mean duration of 44 hours after the end of the storm (Table 1). However, continued flows of groundwater through the structure can slowly carry enough sediment to negate the effectiveness of the facility as can be seen from the 2005 data. On April 30, 2005, the structure initially trapped 27 percent of the sediment that entered the structure, but over the next 14 days (339.6 hours), groundwater leaving the facility continued to carry sediment. At the end of that period almost twice as much sediment (174 percent) had left the facility than had entered during the storm. Over the six storms measured though, the structure initially retained a mean of 64 percent of the TSS that entered the facility through the first round of sampling. This is a relatively high efficiency. As DEP obtains more of this sort of data it will become possible to better evaluate the utility of existing grab sample data by looking to see if the results are similar.

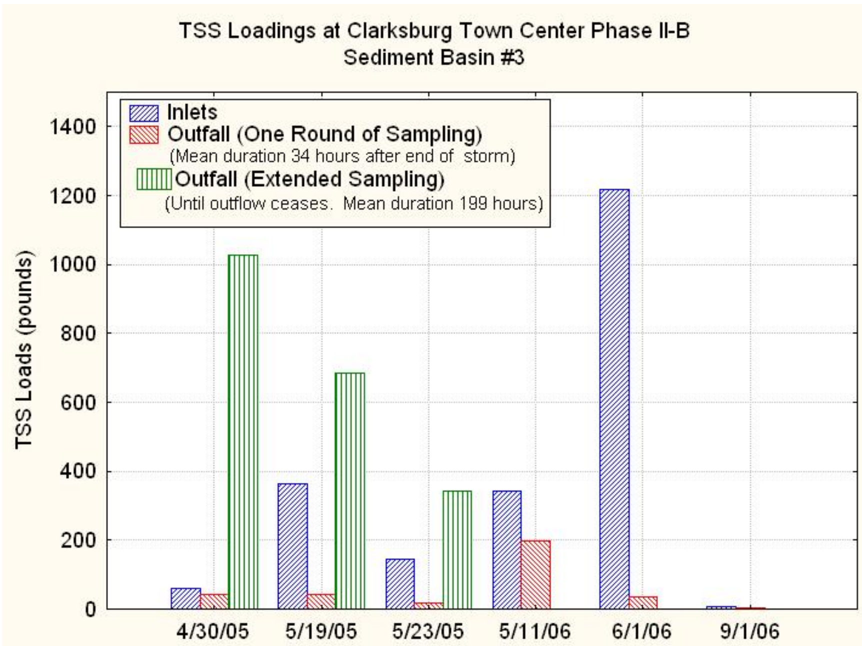

Figure 6. TSS Loadings at Clarksburg Town Center Sediment Basin

Preliminary data has also been received on four flow weighted samples collected in 2006 from the Gateway Commons project. Those samples all show very low TSS concentrations entering the structure for storms with rainfall amounts of 1.11, 1.76, 1.95 and 0.79 inches. The samples were collected after roads and storm sewers were in place, the site was stabilized, and no construction taking place because the project had been required to do additional plan review. There was not enough flow leaving the structure to allow a sample to be collected. The ability of the trap to contain all the flow from these storms means that the structure retained all the sediment that entered and was 100 percent efficient for every storm even though the samples were relatively clean when entering because of the stabilization of the site when the monitoring was conducted.

Stormwater Management BMP Monitoring

Post-construction BMP monitoring evaluates the effectiveness of BMPs in minimizing the long-term impacts of completed developments. This requires that projects be completed and their sediment controls converted over to stormwater management structures before post-construction monitoring can begin. The post-construction monitoring period can extend up to five years on large projects. Although preliminary results may be derived early in the monitoring period, it can take the full five years before all the data and final conclusions from a monitoring project are obtained.
DEP has been accumulating information on post-construction conditions, but most of this data has been on development related changes to the stream habitat and physical quality

such as stream temperature and groundwater level (see Stream Monitoring, Physical Parameters sections). Data is now being obtained on the function of individual stormwater management structures. This is the first report with monitoring results for a sand filter. A larger number of projects are now in the post-construction phase and much more data will be obtained in the next couple of years.

Sand Filter Results

Willow Oaks is an eight acre development mostly in the Piney Branch SPA located on the east side of Travilah Road, opposite Stonebridge View Drive. It was developed using the cluster option and consists of 14 single family lots. About 6.9 acres drain to the Piney Branch SPA. Water quantity control for this portion of the development is provided via an existing SWM pond in the Willows of Potomac subdivision (Pond 2). This pond provides detention of the two year storm with a predeveloped release rate. Quality control is provided by a treatment train consisting of two surface sand filters in series to treat one-inch of runoff over the impervious area (Figure 7). Vegetated filter strips provide pretreatment for the surface sand filters. Chemical and nutrient monitoring were required

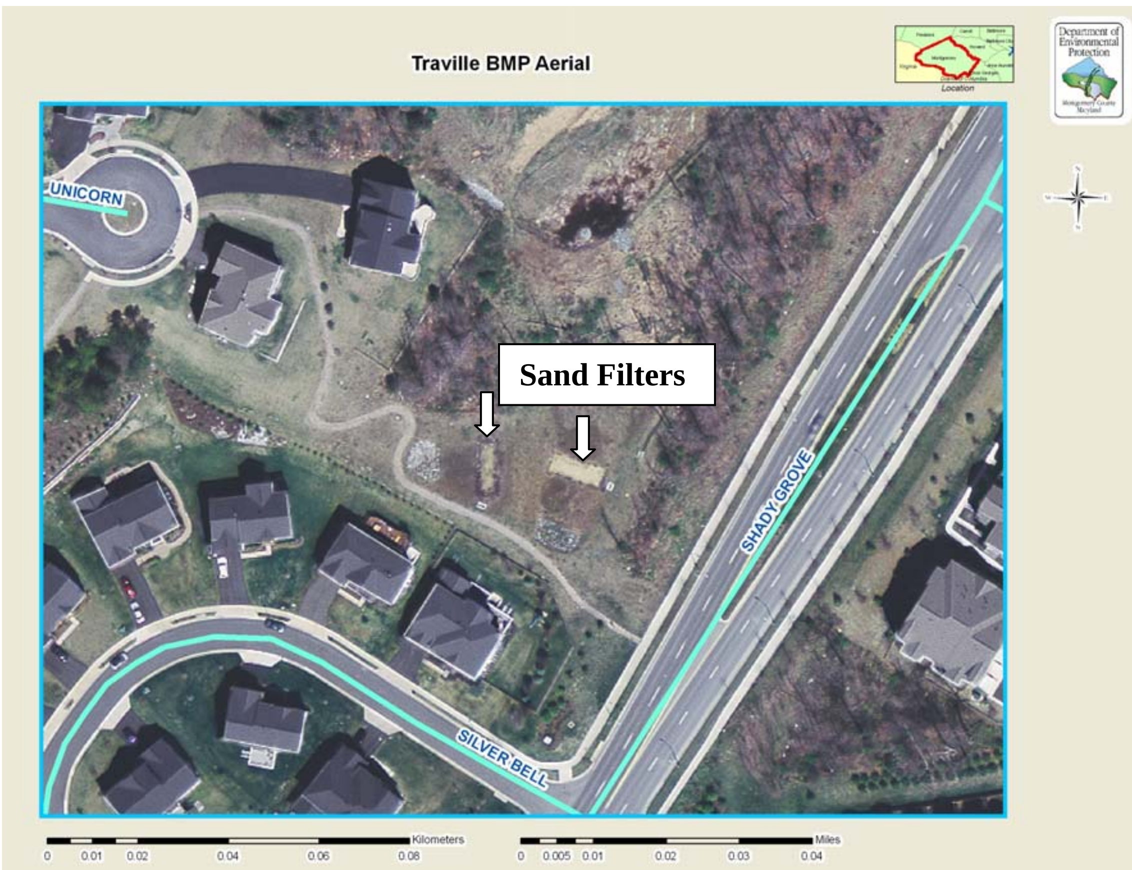

Figure 7. Willow Oaks Sand Filters

at the outlet into the first sand filter and the outlet of the second sand filter cell. Sampling was done using automated samplers. Sampling is to be done four times (quarterly) for three years after construction is complete. Results from 2006 indicate that the BMPs, site design and other features were very effective in maintaining water quality. Generally, pollutants entering the BMP were at low concentrations which may indicate that site design features and vegetated filter strips are having a positive effect. Pollutants that reached the sand filters were generally reduced when they were above detectible levels. Most of the water entering the sand filters did not leave the structure so load reductions could not be calculated. Table 2 shows that for four storms where load reductions could be calculated, pollutant load reduction rates were at least 86 percent.

The infiltration of water on site also means that for the measured storms, the development would not have contributed much to peak storm flows in Piney Branch maintaining flow conditions and stream geomorphology. The infiltration of the stormwater in the BMP should also support baseflows in the stream which acts to maintain stream temperatures and water quality. These sand filters, like many SPA BMPs, were designed to have some storage area beneath the filter medium to promote infiltration. This is dead space, as it is below the level of the drain from the sand filter. After the water level falls below the level of the drain, it can only exit the structure if it can percolate into underlying soils. These structures are designed with dead storage space regardless of soil characteristics. SPA performance goals encourage the infiltration of water back into the ground regardless of the rate of infiltration.

Table 2 Willow Oaks BMP Pollutant Load Reductions

Date	Copper	Zinc	Nitrate	TKN	Total Nitrogen	TSS
1/22/2006	89%	95%	94%	89%	91%	86%
4/21/2006	94%	97%	86%	96%	93%	88%
10/17/2006	96%	98%	98%		98%	99%
11/16/2006			98%		98%	97%

StormCeptor Results

A StormCeptor is a device that is designed to remove grit, fine sediment and free oil from stormwater. It is typically used to pre-treat runoff before it enters a sand filter or other water quality structure. The Cloverly Safeway project has been monitoring a StormCeptor since May, 2003 (Figure 8). A total of ten storm events have been captured out of 15 required for the project. The goals of the monitoring are to evaluate the effectiveness of a StormCeptor in the reduction of pollutant concentrations and loadings during storm events and to monitor the effluent for the presence of temperature pollution. Other BMPs upstream of the StormCeptor consist of stormwater storage underneath the parking area and a bio-retention facility adjacent to the southern section of the parking area. Flow weighted samples of cadmium, copper, lead, zinc and TSS along with a petroleum hydrocarbon sample from the first portion of each storm are collected before and after passing through the structure.

Monitoring activities to date showed some tendency toward reductions in pollutant loadings between runoff at the StormCeptor inlet and outlet for eight out of ten

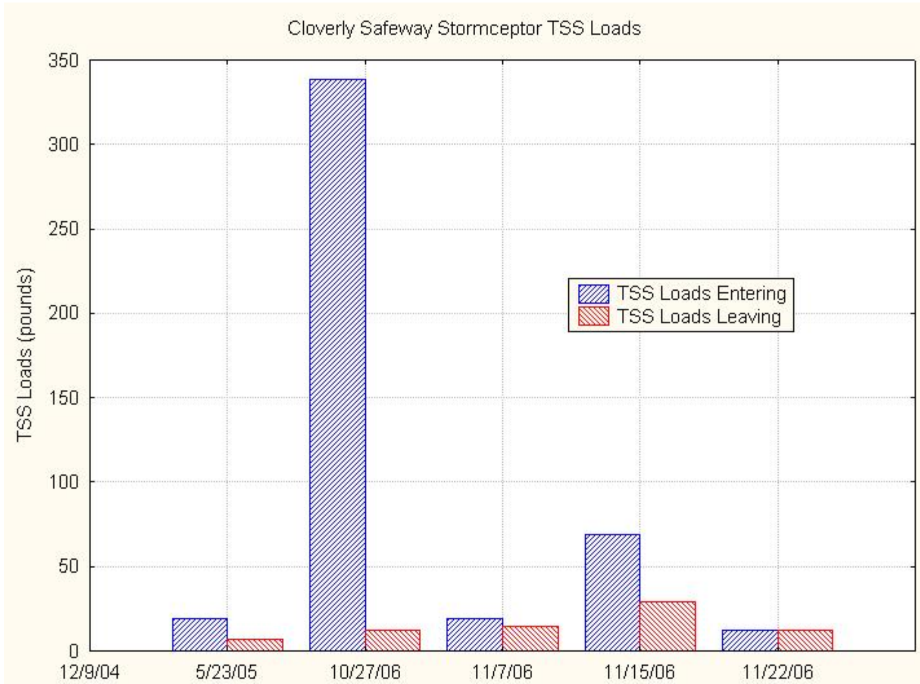

Figure 8. Cloverly Safeway StormCeptor TSS Loads

storm events. These results are preliminary as additional monitoring will continue until the required 15 storms are captured. The structure seemed to work best on TSS. The water entering the StormCeptor has also contained relatively low concentrations of pollutants and it can be difficult to improve on water that already has low pollutant concentrations.

IV. STREAM MONITORING RESULTS

A. General

This section of the SPA annual report presents information on stream monitoring results from 2006. Stream monitoring results continue to produce a broad range of trend data that helps assess how effective the SPA program is in mitigating development impacts to receiving streams.

DEP began stream monitoring within three SPAs, Clarksburg, Piney Branch, and Paint Branch in 1995 and within the newly designated Upper Rock Creek SPA in 2004. Stream monitoring includes biological sampling of benthic macroinvertebrate and fish communities, habitat assessment, stream channel measurements, and water quality readings (dissolved oxygen, temperature, pH, and conductivity). Biological monitoring measures the cumulative impacts that have occurred in the stream. Presently there are 57 fixed monitoring stations throughout the four SPAs where stream monitoring is done, 27 in Clarksburg, 14 in Upper Paint Branch, 10 in Piney Branch and 6 in the Upper Rock Creek SPA. Because of staff constraints, not all 57 stations can be monitored each year. In 2006, 51 stations were monitored during the spring benthic macroinvertebrate index period and 33 were monitored during the fish monitoring period. Fish stations typically take additional staff resources to complete.

In the SPAs, the County attempts to minimize the cumulative effects caused by development and land use change. Biological monitoring is a cost-effective tool to assess the degree of cumulative impacts in streams and rivers including altered stream hydrology, channel erosion, and sedimentation. These factors are often observed when a watershed undergoes extensive land-use change. Stream chemistry and physical parameter measurements, by themselves, generally do not identify the major factors impacting resource conditions in county streams. Careful monitoring and comparison of streams unimpacted by development and streams with ongoing development can identify impacts caused by natural conditions (drought, flooding) from those caused by development (mass grading, sedimentation, increased impervious surface).

B. Physical Parameter Monitoring

Temperature Monitoring

Stream water temperature is a very important factor in maintaining the biological health of streams. SPA BMP design features that help minimize temperature impacts include: 1) requiring enhanced stream buffers and reforestation, 2) minimizing imperviousness, 3) using dry ponds for runoff quantity control to avoid standing pools that soak up excessive heat, 4) promoting infiltration using roadside swales and other infiltration structures, and 5) using sand filters and bio-filtration cells which cool warm water as it filters through soil and sand.

Post-development temperature monitoring has been completed at the following eight projects: Boverman, Briarcliff Manor West, Bruck, Cavanaugh, Clarksburg Detention Center, Fairland Community Center, Gateway 270 and Peters. No thermal impacts of development were identified, indicating that the goal of minimizing temperature impacts has been achieved on these eight projects. Four of the eight projects release stormwater to second order streams where dilution effects from stream flows likely hampered the detection of thermal impacts.

Data from four projects, still under development, do show thermal impacts. Streams below sediment control structures show brief spikes in temperature of several degrees during rainstorms. These spikes were not seen before construction. In three cases, the thermal impacts are probably caused by the release of warm water from sediment control structures. Sediment control structures retain a permanent pool of water which can warm up between storms. When it rains a volume of heated water can be flushed out and cause a temperature spike downstream. Although brief, these temperature spikes can raise the water temperature as much as ten degrees Fahrenheit (F.). Biological monitoring results from Wildcat Branch, one of the locations where temperature spikes have occurred, indicate no impairment to the benthic macroinvertebrate community. In the past these impacts have been limited to small tributaries. In 2006 impacts were seen extending to second order streams. The Clarksburg Village project identified impacts in the mainstem of Little Seneca Creek (Figure 9). With all the development occurring in that area, the impacts are less diluted and carry farther downstream.

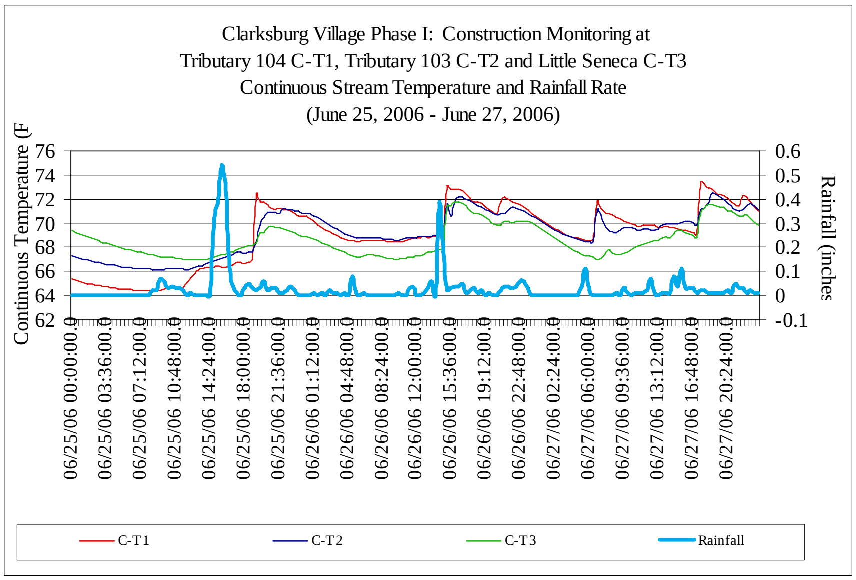

Figure 9. Clarksburg Village Stream Temperatures

Data received from the Traville project show similar temperature spikes, but that project is in the final stages of converting its sediment control structures to post-construction water quality BMPs. This could indicate a more permanent post-construction impact and there is some indication of a general warming trend in streams at the site. Further monitoring will evaluate whether a post-construction impact exists, or if the warming observed at this location in 2006 was associated with the process of reconfiguring the sediment control structure to function as a water quality BMP.

Results of temperature monitoring in Clarksburg are similar to prior years. Temperature data indicates that Clarksburg SPA streams still generally have cool temperatures associated with high water quality. Temperature spikes continue to be observed in the Town Center Tributary though (Figure 10). These temperature spikes are brief and the stream is relatively cold even when exhibiting temperature spikes. Similar spikes have been observed in Wildcat Branch which has maintained *good* IBI scores. These temperature spikes were not observed before construction began in these areas and are likely associated with sediment ponds installed during construction.

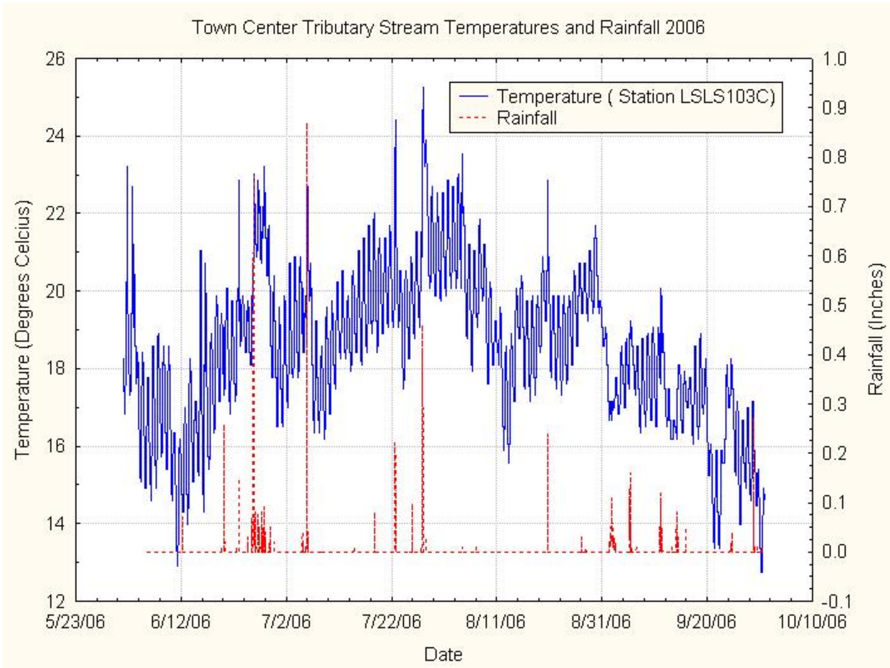

Figure 10. Town Center Stream Temperature

Stream Channel Surveys

Cross section surveys of Clarksburg SPA streams in 2006 indicate some channel instability (Table 3). Five of seven cross sections showed channels that had either eroding banks or material being deposited in the channel. Developing and undeveloped sites behaved similarly. There is no clear trend in this data at this time. The area experienced a series of large storms during 2006 which may have caused some movement of bedload and erosion of stream banks.

2006 Channel Cross Sections Clarksburg SPA		
Station	**Status**	**Developing**
LSLS103B	Deposition	Yes
LSLS103C	Erosion	Yes
LSLS205	Erosion	Yes
LSLS301	Stable	Yes
LSLS101	Erosion	No
LSLS203	Erosion	No
LSLS110	Stable	No

Table 3. Clarksburg Stream Channel Cross Sections

Ground Water Level Monitoring

The County requires some project developers to install and monitor wells on project sites to evaluate changes in groundwater levels as development occurs. As discussed in the 2005 SPA Annual Report, most collected groundwater level data has, thus far, covered only pre-development and during-development conditions phases of development. So far, DEP has received data from the following six projects that have completed groundwater level monitoring: Boverman, Briarcliff Manor West, Cavanaugh, Clarksburg Detention Center, Fairland Community Center and Parr's Ridge. Changes to groundwater levels as a result of the development were reported only from the Briarcliff site in the 2005 SPA Annual Report.

C. Biological Monitoring

Two biological communities are monitored. The monitoring of fish and benthic macroinvertebrate communities has been used nationally and regionally to measure the condition of a stream. Both communities provide information on short-term and long-term impacts. Fish and benthic macroinvertebrates will survive or die in relation to the degree of cumulative impacts in the stream.

Here are some specific attributes of fish that make them desirable components of biological assessments and monitoring programs.

- Fish have large ranges and are less affected by natural microhabitat differences than smaller organisms. This makes fish extremely useful for assessing regional conditions.
- Most fish species have long life spans (2 to10 plus years) and can reflect both, long-term and current water resource quality.
- Fish continually inhabit the receiving water and integrate the chemical, physical, and biological histories of the waters.
- Fish represent a broad spectrum of community tolerances from very sensitive to highly tolerant and respond to chemical, physical, and biological degradation in characteristic response patterns. (http://www.epa.gov/bioindicators/html/fish.html).

Aquatic benthic macroinvertebrates live in the bottom parts of our waters. Benthic macroinvertebrates also make good indicators of watershed health because they:

- Live in the water for all or most of their life, staying in habitat areas necessary for their survival,
- Rapidly respond to short term impacts as they differ in their tolerance to amount and types of pollution,
- Have limited mobility, and
- Are integrators of the chemical, physical, and biological histories of the receiving stream. (http://www.epa.gov/bioindicators/html/invertebrate.html)

Measures (metrics) of each biological community are assembled to form an Index of Biological Integrity (IBI). Metrics are selected that respond in a predictable way to increasing degrees of cumulative impacts. Metrics are scored in comparison to the least impacted streams in the region. The Final IBI creates an index that compares any stream against conditions found in these least impacted streams. Streams can be rated as *excellent*, *good*, *fair*, or *poor*.

Clarksburg SPA

Land use change in the Clarksburg SPA far exceeds that of the other three SPAs. During 2006, development was either underway or completed on eighteen development projects (Figure 11) for a total of 1,409 acres.

Most of the new development that has been started in Clarksburg is located within the Little Seneca Creek watershed and concentrated near the new Clarksburg Town Center. This area is densely developed. Many parcels were designated as Transfer Development Right (TDR) receiving areas after the master plan was adopted which increased imperviousness. Figure 11 identifies the projects underway or recently completed in the Clarksburg Master Plan SPA.

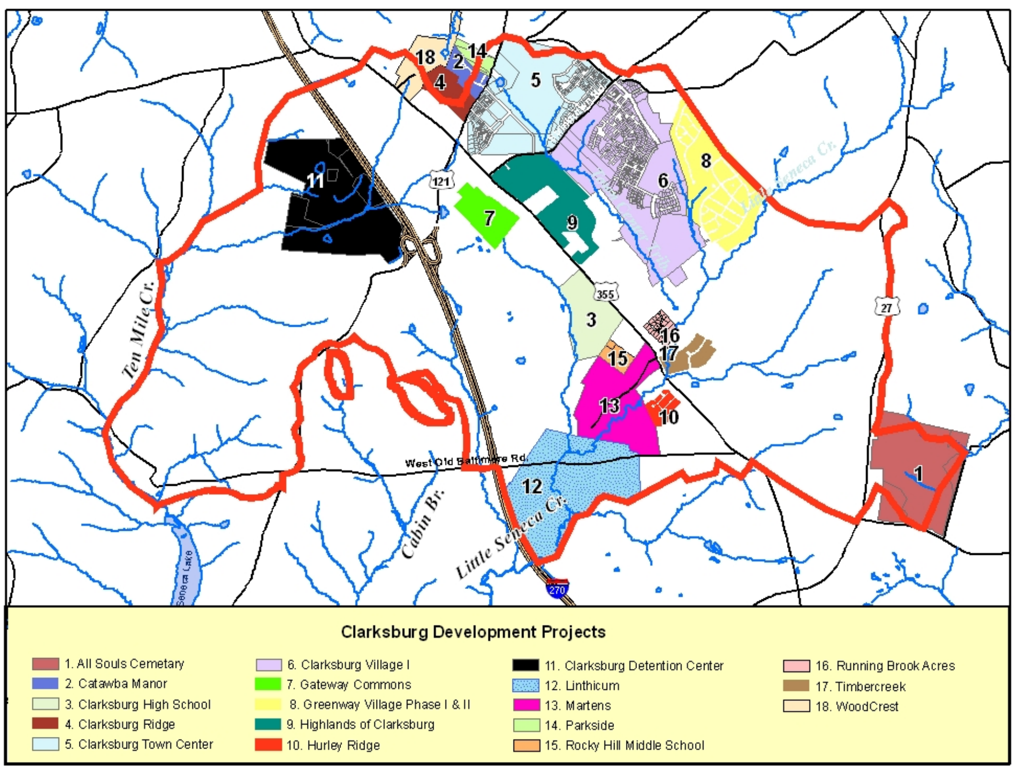

Figure 11. Development Activity in Clarksburg SPA

Macroinvertebrates

Benthic macroinvertebrate IBI scores in 2006 continued the trend shown in recent years. Scores from subwatersheds with little development activity continued to indicate high water quality conditions. Scores from subwatersheds with extensive development activity remained significantly lower. Benthic IBI categories of the various sub-watersheds in Clarksburg SPA are shown (Figure 12). Comparison of the map below with Figure 11 clearly shows the relationship between recent development activity and benthic macroinvertebrate IBI scores. Areas with construction activity generally had *poor* or *fair* IBI scores.

The Town Center area of Clarksburg SPA has been the center of development activity in this SPA as shown on Figure 11. Water quality in that area has suffered as seen on Figure 12. This area always had *good* to *excellent* water quality prior to development. Areas without construction generally had *good* IBI scores. This indicates that construction activity is having a localized negative impact on water quality in the area.

This trend began in 2003 when benthic IBI scores from subwatersheds with development activity dropped below those from subwatersheds without development activity (Figure 13). The mean for the developed subwatersheds was the lowest ever in 2006 (53 percent of the best possible score). The mean for undeveloped subwatersheds remained high at 80 percent. This decline in benthic IBI scores is associated with the cumulative and

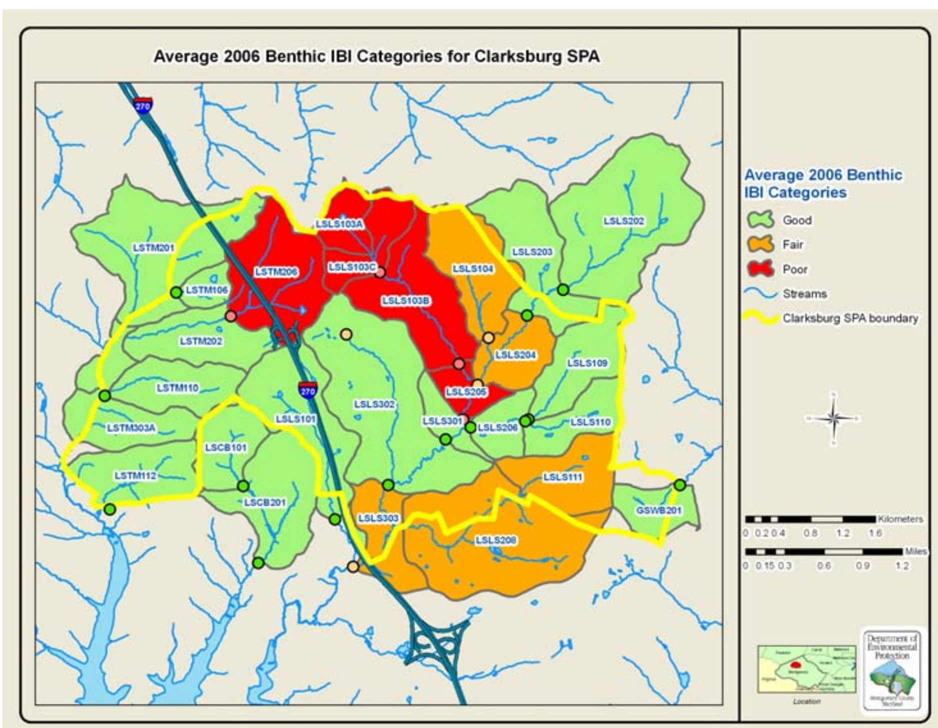

Figure 12. Subwatershed Benthic IBI Scores in Clarksburg SPA

multiple impacts associated with development. These cumulative impacts include increased sediment loadings, increased nutrient loadings, and runoff from newly installed asphalt surfaces, treated lumber or metal roofing materials, changed hydrology, excessive application of lawn care chemicals or other factors. Hopefully, conditions will improve once construction has been completed and sediment control structures have been converted to post-construction water quality structures. It could be many years before all the sediment control structures in the Clarksburg area have been converted over. All building has to be completed within a structure's drainage area before the process can begin. Even then, it is a slow process to convert the structure, stabilize all the soils, get grass to grow and put the completed stormwater management device on line. Because construction impacts are localized, watersheds with little activity such as the mainstem of Ten Mile Creek, Cabin Branch and Wildcat Branch have maintained *good* water quality conditions.

In the upper portion of Ten Mile Creek IBI scores from LSTM206 have indicated lower stream conditions for some time. DEP has investigated this and found high conductivity values throughout the drainage area to the station. No specific cause for the high conductivity readings could be identified. The other stations in Ten Mile Creek all continue to indicate *good* stream conditions

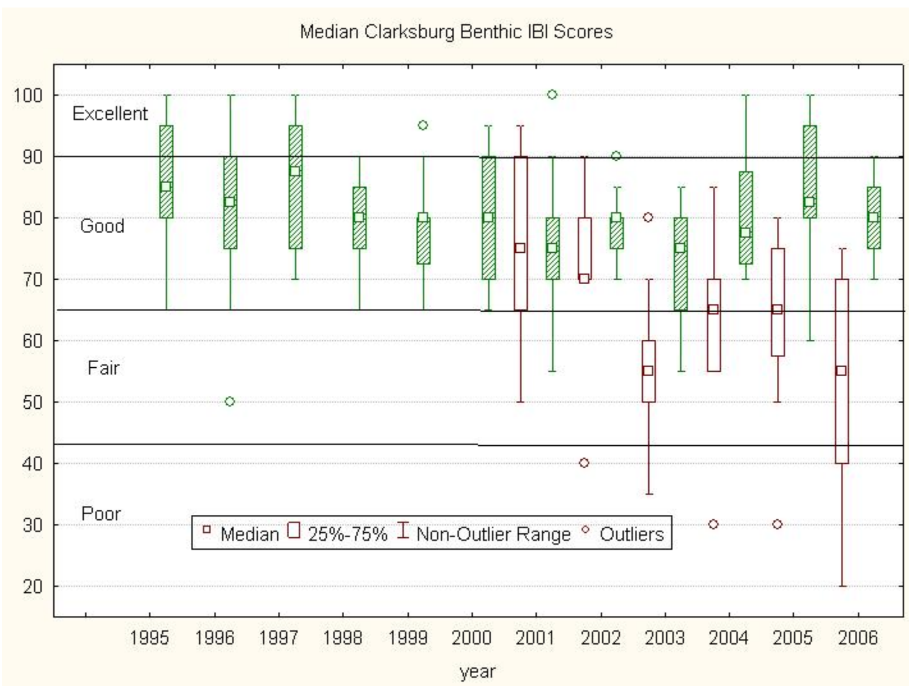

Figure 13. Benthic Macroinvertebrate Monitoring Results from Two Groups of Monitoring Stations.
Group 1 (Clear) – Within Development Area.
Group 2 (Green) – Outside Development Area.

The Little Seneca watershed, with more extensive construction impacts, shows more decline. The declines are greatest in the areas of the Little Seneca watershed that have the most extensive construction. IBI scores in the tributary draining the Town Center area indicated *poor* conditions. This tributary consistently demonstrated *excellent* or *good* conditions before development began in this area.

Fish

Data from fourteen Clarksburg SPA sites where fish communities were sampled are presented in Figure 14. Nine stations were in the *good* or *excellent* range and three stations were in the *fair* range. LSLS303 was in the *fair* range in 2006. This is probably due to the cumulative impacts of past and current land uses and local habitat conditions within the drainage area to the monitoring station. The station is below a previous cattle farm and the Interstate 270 crossing over Little Seneca Creek. The Milestone Tributary (drainage includes highly impervious areas of Germantown) also enters the Little Seneca mainstem here. The physical characteristics of the stream channel had changed from prior years. Some high quality riffle areas were under deeper slower flowing water. Some pools had increased in depth to the point that they were difficult to sample. In addition, Benthic IBI scores from this site have tended to be low in past years relative to the rest of Clarksburg SPA.

Benthic macroinvertebrates are likely a better water quality “indicator” group in Ten Mile Creek because the stream was cut off from the rest of the Little Seneca Creek watershed when the Black Hill Lake was built in the 1980’s. Severe droughts (1999 and 2002) resulted in the Ten Mile Creek mainstem drying up to isolated pools. Tributaries continued flowing and provided refuge for some fish and benthic macroinvertebrates.

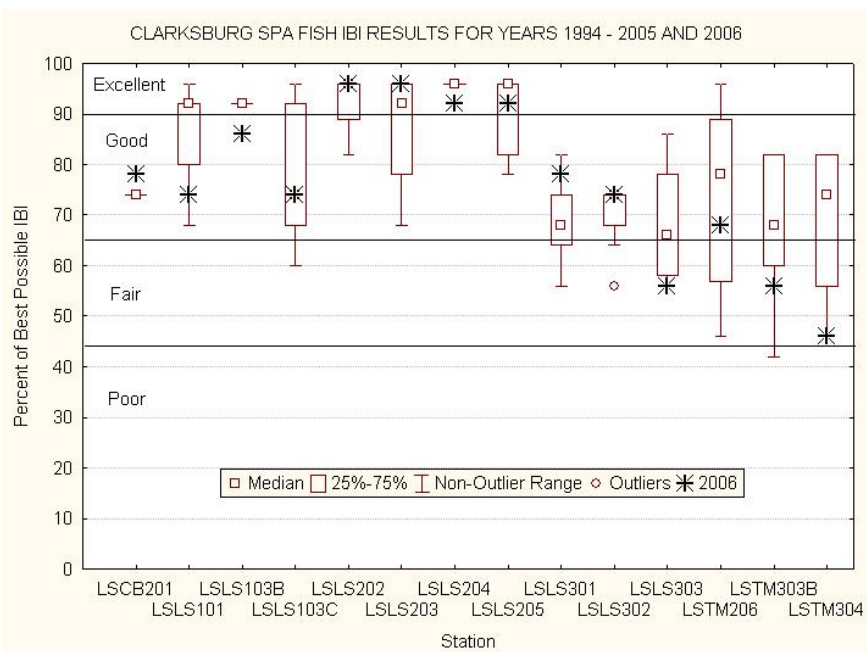

Figure 14. Clarksburg Fish IBI Values

Fish populations were greatly reduced however with more tolerant species having a higher survival rate. Introduced fish from the lake and ponds have also moved into the lower portions of Ten Mile Creek. Three stations were monitored for fish in 2006 – two stations low in the watershed (LSTM304, LSTM303B) and one in a tributary with past stream condition problems (LSTM206).

Paint Branch SPA

Construction of new development projects in the Paint Branch SPA has occurred mostly in the Right Fork subwatershed. Five projects are either under development, planned for, or already built on a total of 336 acres or approximately one third of the total drainage area in the Right Fork sub-watershed. Two of these projects, Briarcliff Manor West and Fairland Community Center, have been completed. Two projects, Hunt/Lions Den and Fairland Farms, are nearing completion. One project, Peach Orchard/Allnutt, may be deeded to MNCPPC as part of a parkland mitigation package for parkland losses elsewhere due to the Intercounty Connector. Figure 15 shows the location of eight large new development projects built in the Paint Branch SPA since 1995. Projects shown in

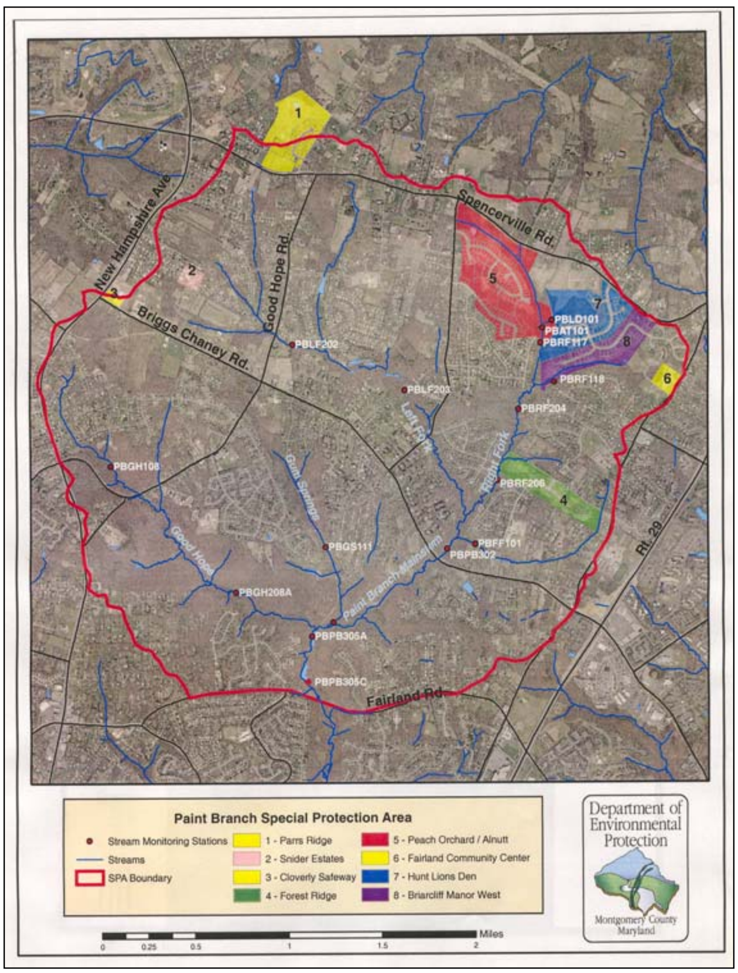

Figure 15. Paint Branch Special Protection Area

Figure 15 account for 410 acres or 75 percent of the 546 total acres developed since 1995. The remaining 25 percent are small projects (less than 4 acres) scattered throughout the Paint Branch SPA.

Macroinvertebrates

Benthic macroinvertebrate monitoring results from 2006 (Figure 16) indicate that this community has reacted negatively to the cumulative impacts occurring in the watershed. This is represented by a decline in stream conditions throughout the watershed in the past year. Only three sites were at or above their long term mean values and eight out of the twelve sites were well below their long term mean values. The six stations in the Right and Left Forks of Paint Branch all had low values. Those stations have generally been in the *good* range in past years, but were mostly *fair* in 2006. Elsewhere in the watershed, PBGG108 and PBPB302 had much lower than normal values. The weather in 2006 was fairly typical for the area with few extreme conditions. Stream temperature data from three Paint Branch stations did not show unusually high temperatures during the summer. Results from Piney Branch and Clarksburg SPA do not indicate any unusual impacts to water quality due to climatic conditions. A cause for this decline has not identified.

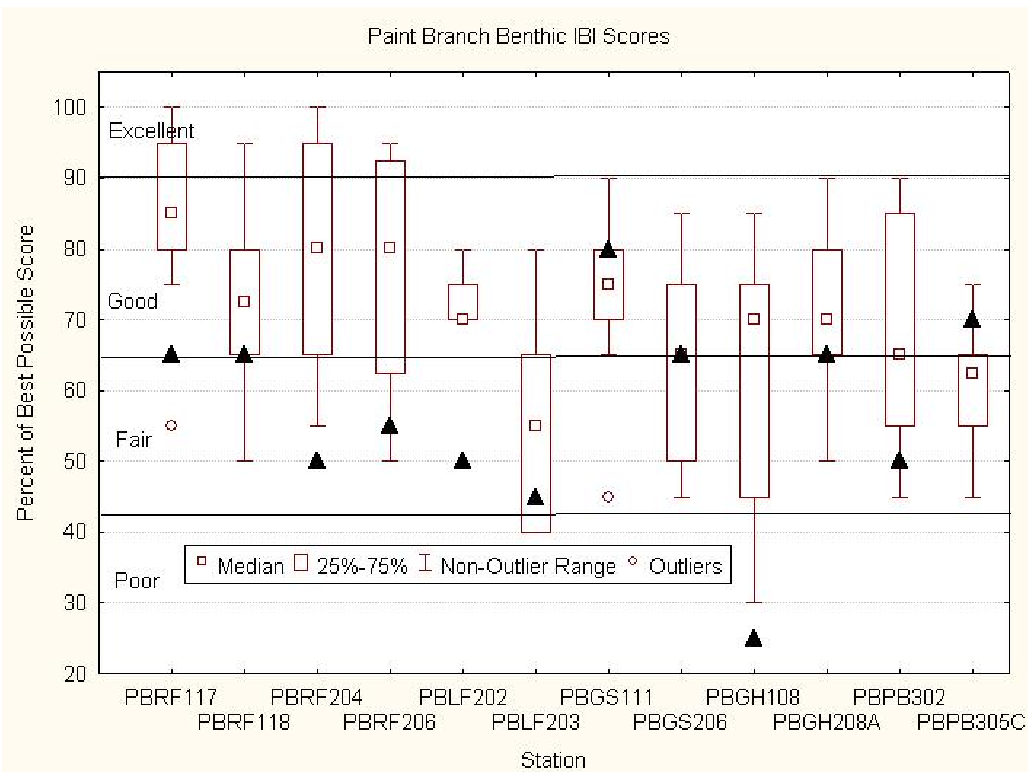

Figure 16. Paint Branch Benthic IBI Scores

Fish

Fish IBI scores remained high at most sites in 2006 (Figure 17). All sites were in the *excellent* range except for PBGH108 and PBLF202 which were in the *good* range. Those two sites have smaller drainage areas which results in there being less in-stream habitat and a smaller volume of water sampled in the 75 meters of stream length sampled at each

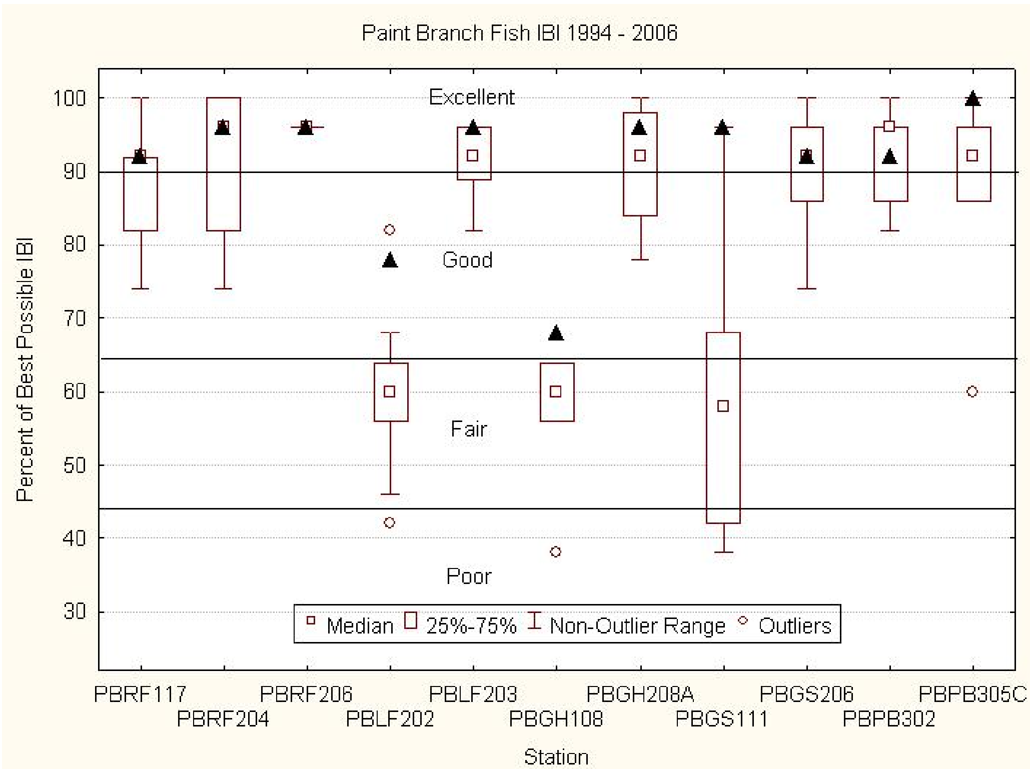

Figure 17. Paint Branch Fish IBI Scores 1994-2006

site. Ten out of the 11 sites sampled were above their long term mean IBI values. Monitoring of Paint Branch fish populations over time has generally indicated the fish community (with the exception of the brown trout population) has not been as affected from cumulative impacts as the benthic macroinvertebrate community.

In 2005 a total of 14 adult brown trout were found at the Paint Branch SPA stations sampled. In 2006 only four adult trout were found which is more typical of results since 2000. The number of young of year trout collected in 2006 (14) was three more than were collected in 2005 and is also similar to values obtained since 2000. SPA sampling found many more trout in Paint Branch from 1994 to 1999 (Figure 18). The population is persisting, but at low levels at all stations. The Good Hope tributary which has generally had larger numbers of fish remained low for another year. Since the Good Hope tributary has generally contained a large proportion of the population in the past, fewer fish here is another sign that the population is not flourishing.

The Maryland Department of Natural Resources (DNR) has reported a loss of habitat in the lower portion of the Good Hope tributary due to sedimentation of the stream bottom in areas where trout spawning had previously been observed which is a likely cause for low trout numbers in this tributary. Because there have been no significant development projects built in the Good Hope subwatershed during the last ten years, the likely source of sediment is stream bank erosion. No effects of SWM controls in reducing bank erosion have been seen yet. Stormwater runoff from older developments often lack stormwater management which can result in frequent high flows and accelerated stream bank erosion.

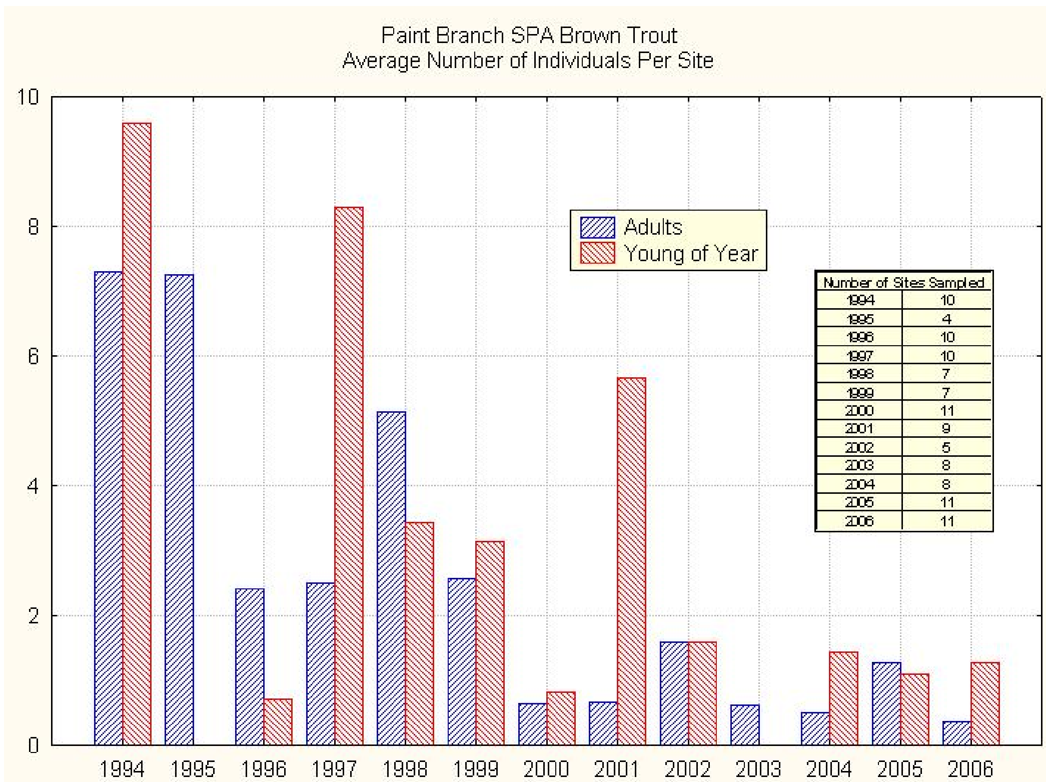

Figure 18. Paint Branch Brown Trout Captured 1994-2006

Habitat Restoration and Stormwater Retrofit Measures in Paint Branch

The County continues to pursue stream restoration and SWM retrofit initiatives in the Upper Paint Branch SPA in order to support water quality goals in the Paint Branch watershed.

In 2006 two new projects were completed. The Peachwood Park stream stabilization project rehabilitated 700 linear feet of stream below a stormdrain outfall in the Park that had severe erosion and a degraded channel. The drainage area consists of older development with no stormwater management. The uncontrolled runoff from that area had over time caused the channel to cut downward degrading stream habitat and sending large amounts of sediment downstream. The project stabilized the stream below the outfall and improved the habitat which should lead to improved water quality conditions.

The new Gum Springs stormwater management pond and buffer reforestation project completed in 2006 controls 122 acres that previously had no stormwater management (Figure 19). The pond is near the intersection of Sturtevant Road and Ansted Road. The area controlled is 18 percent of the drainage area of Gum Springs at that point. The pond will greatly reduce peak flows from most small frequently occurring storms. Larger less frequent storms that only occur on average every six months will have their peak flow rates attenuated by 70 percent. Even larger storms that on average only occur once a year will have their peak flow rates reduced by 44 percent. This change in runoff patterns should have a beneficial effect on Gum Springs by reducing stream bank erosion and in-stream sediment loads. Over 1.3 acres of stream buffer area were reforested in association with construction of the pond which should also contribute to improved water quality conditions in Gum Springs.

Figure 19. Gum Springs Stormwater Management Pond

Monitoring of stream restoration projects is done to measure whether specific project design goals were met. Monitoring takes place before, during, and for five years after completion of the project. As results are available, they will be shared through these annual reports and restoration project reports.

Case studies on several of these projects are presented in the 2004 Special Protection Area annual report (available at: http://www.montgomerycountymd.gov/content/dep/SPA/2004report.pdf).

Piney Branch SPA

The Piney Branch SPA (Figure 20) is near maximum build-out allowed under the Master Plan. Analysis conducted in 2005 by the MNCPPC found that 121 acres or five percent of the 2,369 total acres in the Piney Branch SPA remain available for development. Most of the new development has occurred in the upper portion of the watershed (upstream of monitoring station WBPB203B) and predates SPA law (Figure 21). Two developments, Willows of Potomac and Piney Glen village, together cover approximately 433 acres or 41 percent of the 1,042 acre drainage area at monitoring station WBPB203B.

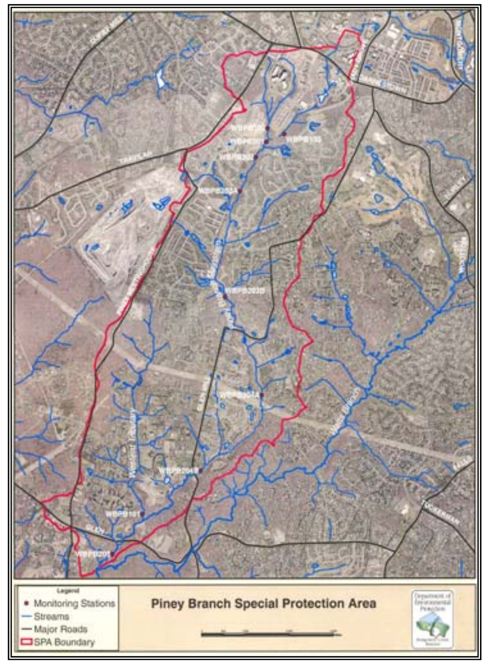

Figure 20. Piney Branch Special Protection Area

Construction on these two developments began in 1995 and was completed in 1999. As these two large development projects were nearing completion, development on the Traville property was beginning with the construction of Shady Grove Road (extended) in 1998.

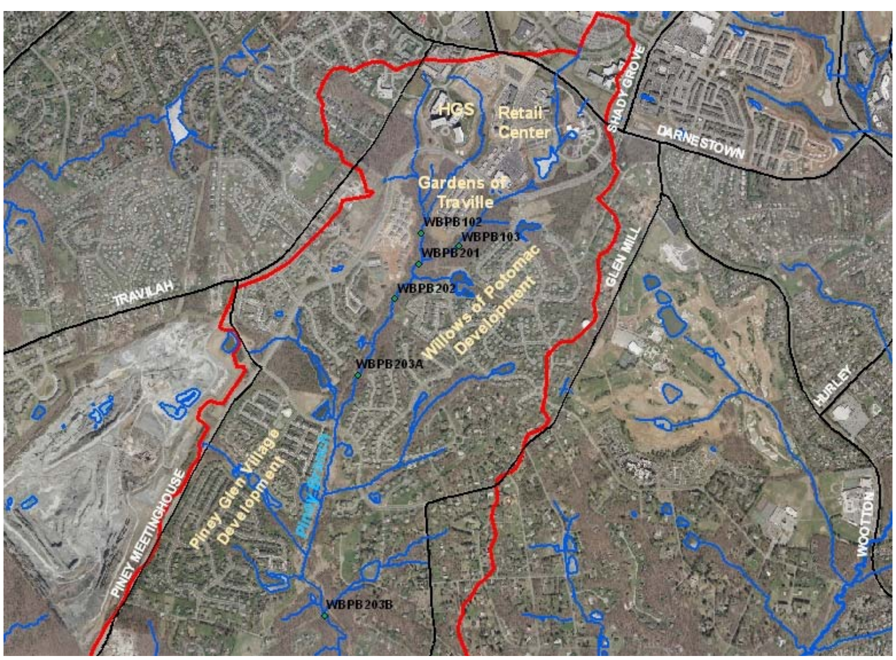

Figure 21. 1998 Aerial photo of Piney Branch SPA Showing Willows of Potomac, Piney Glen Village and Shady Grove Rd. SPA Boundary in Red.

Most of the development projects on the 192 acre Traville property have been completed including Human Genome Sciences, Retail Center, Avalon Bay (Lots 3 and 5) and Gardens of Traville. Development in the area is not completely finished though. As of 2006, several sediment control structures on the site are still undergoing conversion to post-construction water quality configuration. Many of the already converted structures also require modifications before they can be considered completed and accepted into the County's Stormwater Facility Maintenance Program. The Traville projects still have open sediment control permits open and have not begun their post-construction monitoring. Once conversion has occurred, stream conditions will reflect post-construction conditions.

Macroinvertebrates

Benthic macroinvertebrate monitoring results from 2006 indicate that the biological community has reacted negatively to the cumulative impacts occurring in the watershed (Figure 22). This is represented by a decline in stream conditions throughout most of the watershed over time (Figure 23). The current stream conditions in most of Piney Branch are generally in *fair* or *poor* condition. The headwater streams near the newly developed Traville areas have the lowest IBI scores.

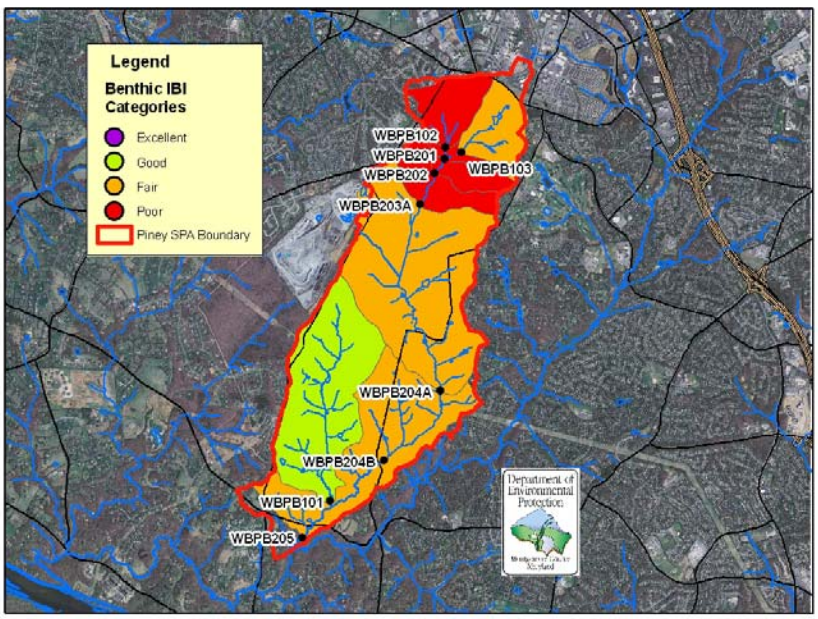

Figure 22. Piney Branch Benthic IBI Scores 2006

The Western Tributary where station WBPB101 is located is the exception and is used as a control. The Western Tributary has consistently supported populations of benthic macro-invertebrates that indicate *good* stream conditions except for 1996 and 1997. Flooding in February of 1996 may have impacted the community for those two years. The station is located in an area where stream temperatures are consistently low. It has a large drainage area with large lot development and a relatively low percentage of imperviousness (4.2 percent). The stream seems to have a good groundwater supply combined with the upstream land use to explain the consistently healthy benthic macroinvertebrate community. The Piney Branch mainstem could be expected to have IBI scores similar to the western tributary. The difference is likely due to the highly developed condition of the upper portion of the Piney Branch watershed. It is possible that in time stream conditions will improve as the last BMPs are completed and the stream and biological communities have time to adjust.

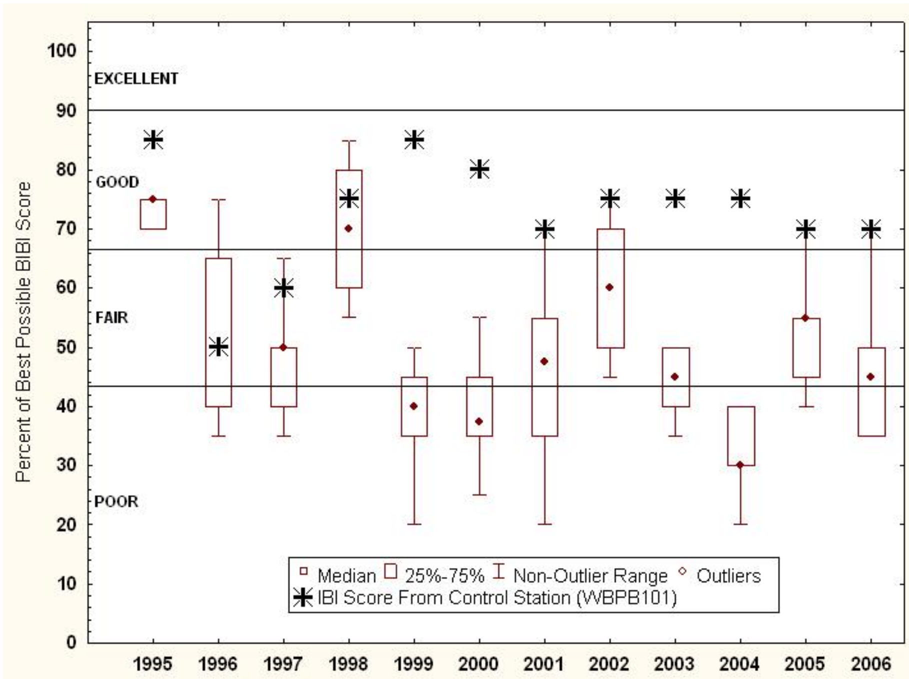

Figure 23. Piney Branch Benthic IBI Scores 1995-2006

Fish

Over the past twelve years fish communities in the upper portions of Piney Branch (WBPB201, WBPB202 and WBPB203A) have generally indicated *fair* stream conditions (Figure 24). Results from stations in the lower portions of the watershed have generally indicated *good* to *excellent* conditions (WBPB203B, WBPB204A and WBPB205). This pattern continued in 2006 and is likely due to the lesser drainage area and smaller stream size in the upper portions of the watershed. The smaller stream size means less habitat resources are available to fish populations and a lesser volume of habitat is contained in the sampled seventy-five meters of stream in an SPA sample site. The fish community in the Upper Piney Branch is made up mostly of pioneering fish species. These are hardy fish that occupy the furthest upstream portions of a stream where flow is too low and variable to support other fish species. Downstream of monitoring station WBPB203A, the stream is larger and supports a more diverse fish community. Consequently, IBI scores are higher at monitoring stations located in these downstream areas.

Overall, fish IBI scores in Piney Branch have been remarkably stable over time and only showed any marked change during a record drought that the area experienced in 2002. The fish communities seem more resilient to ongoing cumulative impacts in the watershed than the benthic macroinvertebrate communities. The average number of fish that are not tolerant of decreasing water quality or habitat stressors captured per Piney Branch monitoring station peaked in 1996, declined steadily from 1997 to 2001, reached a low after the 2002 drought and has recovered somewhat since (Figure 25).

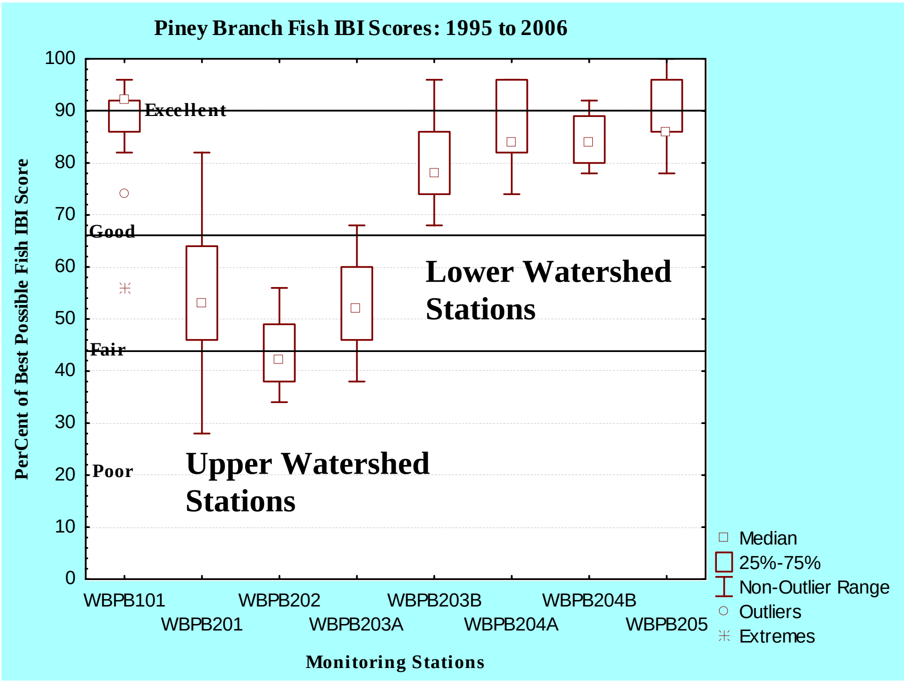

Figure 24. Piney Branch Fish IBI Scores 1995-2006

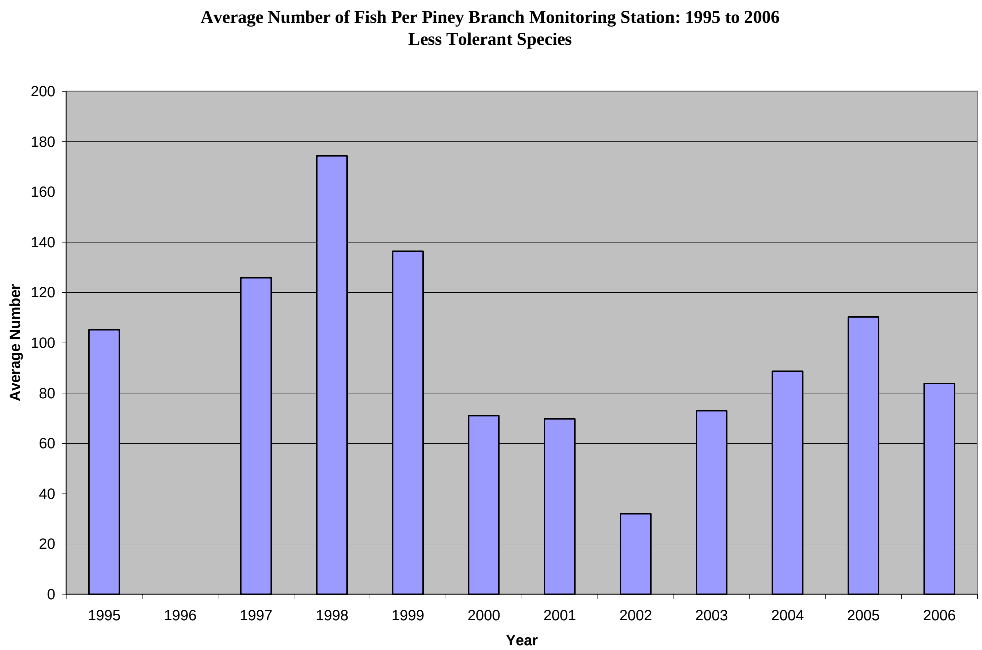

Figure 25. Average Number of Fish Per Piney Branch Monitoring Station: 1995 - 2006

For example, Potomac and Blue Ridge sculpins are species that are very sensitive to stream degradation because they live on the stream bottom and are susceptible to impacts of sedimentation. The numbers of sculpins are above the very low numbers seen during the drought of 2002, but are still well below their long term averages. The number of sculpins has also fluctuated over time in a similar pattern as depicted in Figure 25.

Upper Rock Creek SPA

A portion of the Upper Rock Creek watershed was designated as Special Protection Area in the Olney Master Plan adopted in February 2004. The Upper Rock Creek SPA includes the entire Upper Rock Creek watershed north of Muncaster Mill Road and west of Rock Creek North Branch (Figure 26).

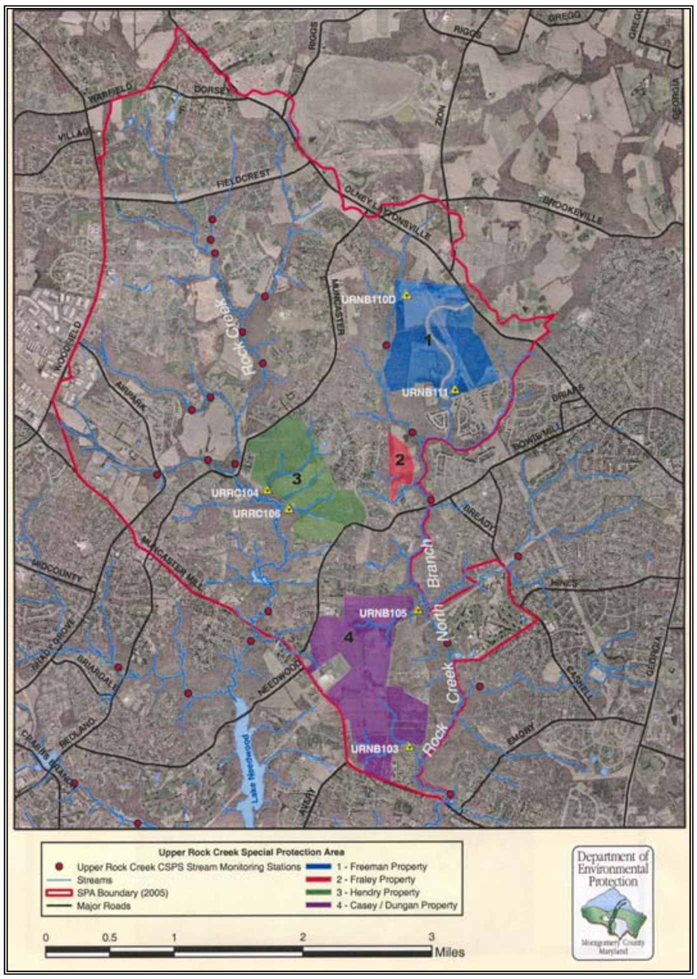

Figure 26. Upper Rock Creek SPA Showing Large Developable Parcels and SPA Sampling Stations (yellow triangles)

When the Upper Rock Creek SPA was designated, DEP established six new monitoring stations from which biological sampling (benthic macroinvertebrates only), habitat assessment and water quality measurements will be done annually. The six monitoring stations are located in small tributaries that drain parcels of land slated for development (Figure 26). Because of small stream size at all six monitoring stations, fish sampling is not appropriate.

Benthic macroinvertebrate sampling was completed at all six monitoring stations in 2004, 2005 and 2006. Results show community health in all of these streams is in the *good* to *excellent* range (Figure 27). The biological community is indicative of good habitat and water quality conditions. Slightly lower IBI score at URRC104 is likely due to problems with the stream habitat.

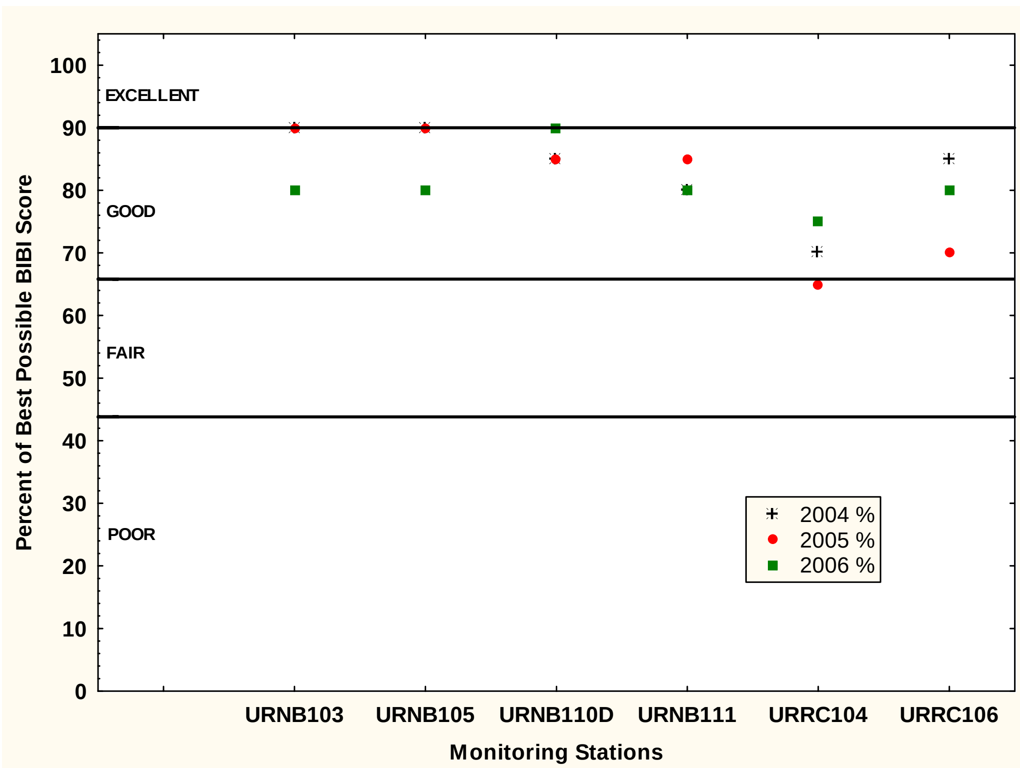

Figure 27. Upper Rock Creek Benthic IBI Scores 2004 – 2006

V. SUMMARY

Development of new SPA development projects over the last ten years has been concentrated in three areas: 1) Traville – located in the headwater area of Piney Branch, 2) the Right Fork of Paint Branch, and 3) the Clarksburg Town Center and Village areas. The stream condition in these watersheds has declined. However, the level of decline varies with the intensity and imperviousness levels of the new development.

County streams respond to the cumulative impacts associated with both man-made and natural stressors. Man-made stressors to the stream ecosystem include such things as: 1) increased sediment input from development sites, 2) increased levels of nutrients entering the stream which leads to increased biological oxygen demand, 3) increased biological oxygen demand causing low dissolved oxygen levels at night, 4) thermal impacts as stormwater runoff from heated surfaces (e.g., roads and rooftops) and warm water flushed out of sediment traps enters the stream, and 5) increased peak flows during storm events. In addition, legacy impacts from historic land use changes have caused early sedimentation of stream valleys that can be eroded when disturbed by development activities or changes in runoff patterns.

The most influential natural stressor is drought, which causes extremely stressful conditions in the stream. Cumulative impacts associated with development increase these stressful conditions. Two droughts in recent years, 1999 and 2002, had a negative effect on the biological health of all SPA streams. In streams that were also influenced by the cumulative impacts related to development, the biological health further declined. The biological community in most SPA streams outside of the active development areas recovered from drought conditions. In those streams receiving impacts from large-scale development activity, the biological community did not fully recover from drought conditions.

The County has compared changes in SPA stream conditions relative to the intensity of changes in land uses that occurred. As anticipated, stream conditions have generally decreased as the imperviousness level of watershed development increased. For example, benthic macroinvertebrate monitoring results show Piney Branch, the most developed SPA tributary, has the lowest rated stream condition, while Ten Mile Creek, the least developed SPA tributary within the Clarksburg SPA, has the highest rated stream condition (Figure 28).

Watersheds such as Ten Mile Creek and Cabin Branch where little or no development has occurred have the highest quality stream conditions. Changes observed in these watersheds are due to natural variability or from existing land uses (Figure 28).

Streams in subwatersheds where large areas of grading and filling of parcels are occurring as part of the development process are showing greater decline in biological health. In the Clarksburg SPA, for example, the Town Center tributary receives runoff from moderate to high intensity development within the new Clarksburg Town Center. Stream conditions declined sharply in this tributary from levels indicative of *good* condition (sustained during a six-year period, 1997 – 2002) to *poor* condition in 2003 and 2004. Several observed stream impacts were initially responsible for decline in this area, including, severe drought, high rates of algae growth, a water main break and associated sedimentation. Stream flows in the region were near or above average during 2003 and 2004 providing favorable conditions for biological communities to recover from severely stressful drought conditions that existed during 2002. However, the continued presence of fine sediment coating the stream bottom, primarily the result of discharge from development sites, appears to be hindering the recovery of biological health.

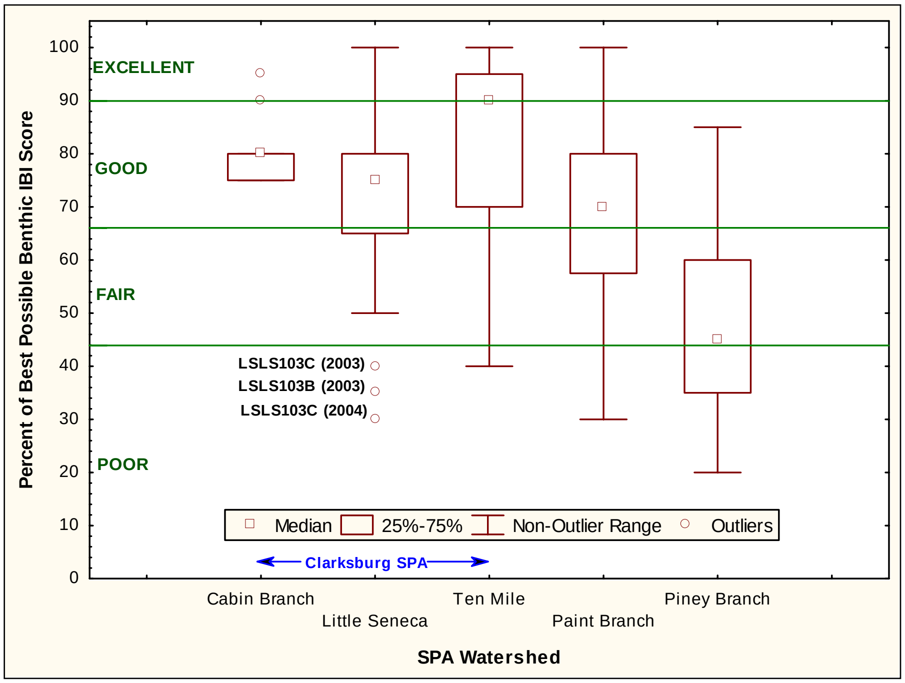

Figure 28. Results of all Benthic Macroinvertebrate Monitoring in SPA Watersheds (1995-2004)

Even with sediment control structures maintained and functioning as designed, some of the fine sediment discharges will still reach and impact stream channel habitat and resident aquatic life.

Observations from analyzing the SPA stream monitoring data include: 1) stream conditions will decline as intensity and degree of imperviousness of development increases, and 2) the biological community in a stream undergoes a significant degree of change from impacts during the construction phase of development. Recovery may take time and streams may not recover to pre-development conditions.

Achieving desired densities in highly impervious SPA developments has received a higher priority over sediment and erosion control and SWM requirements. This continues to cause problems arriving at cost-effective and practical siting decisions for sediment and erosion control structures and stormwater management facilities. In some cases, these decisions have required locating stormwater management quantity structures near environmentally sensitive stream valley buffers, or in areas with high water tables because little room was provided in other less environmentally sensitive areas in order to achieve desired lot yields.

Solely relying on engineered structures will not be 100 percent successful in maintaining *good* to *excellent* stream conditions. The structures must be fully integrated into environmentally sensitive site designs from the start. Headwater streams cannot support the levels of imperviousness that larger streams may be capable of. This is evident after monitoring the reaction of the Paint Branch headwaters (with 10 percent imperviousness) to those of the Clarksburg headwaters (no imperviousness cap).

County Code Chapter 19 should be revised so that future BMP monitoring will be managed by the County and not by SPA project developers. Monitoring costs should be funded through a BMP monitoring fee. Monitoring of BMPs is currently done by private consultants paid for and managed by the developer. The monitoring is approved as part of the Water Quality Plan and is done on the specific development site. This regulatory requirement makes it difficult if not impossible to revise monitoring plans once approved or to move the monitoring to other sites and other BMPs that have a higher priority to be monitored.

While no definitive monitoring results yet exist, DEP and DPS believe there is a need to explore ways to provide additional stormwater treatment once site development reaches a stage where roads are in place, lots are final graded, and stormwater is being conveyed through a storm drain system, but prior to as-built approval.

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RELATED DOCUMENTS:

- SPA Annual Report, 2005
- SPA Annual Report, 2004
- SPA Annual Report, 2003
- SPA Annual Report, 2002
- SPA Annual Report, 2001
- SPA Annual Report, 2000
- SPA Annual Report, 1999
- SPA Annual Report, 1998
- Clarksburg Conservation Plan
- Piney Branch Conservation Plan
- Upper Paint Branch Conservation Plan

All of the documents cited above are available online in PDF format on our website:
http://www.montgomerycountymd.gov/deptmpl.asp?url=/content/dep/SPA/home.asp
In addition, the Department of Environmental Protection maintains an extensive collection of annual, technical, and general reports, public information factsheets, and related publications. Many are available in both PDF and HTML format, and in some cases, print copies of documents are available. Please contact us for more information.

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